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MICHIGAN.

SURVEY OF ST. CLAIR FLATS

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STATE OF MICHIGAN

REPORT OF

SURVEY OF ST. CLAIR FLATS

BY THE

COMMISSIONER OF STATE LAND OFFICE

UNDER AUTHORITY OF

ACT NO. 175, P. A. 1899

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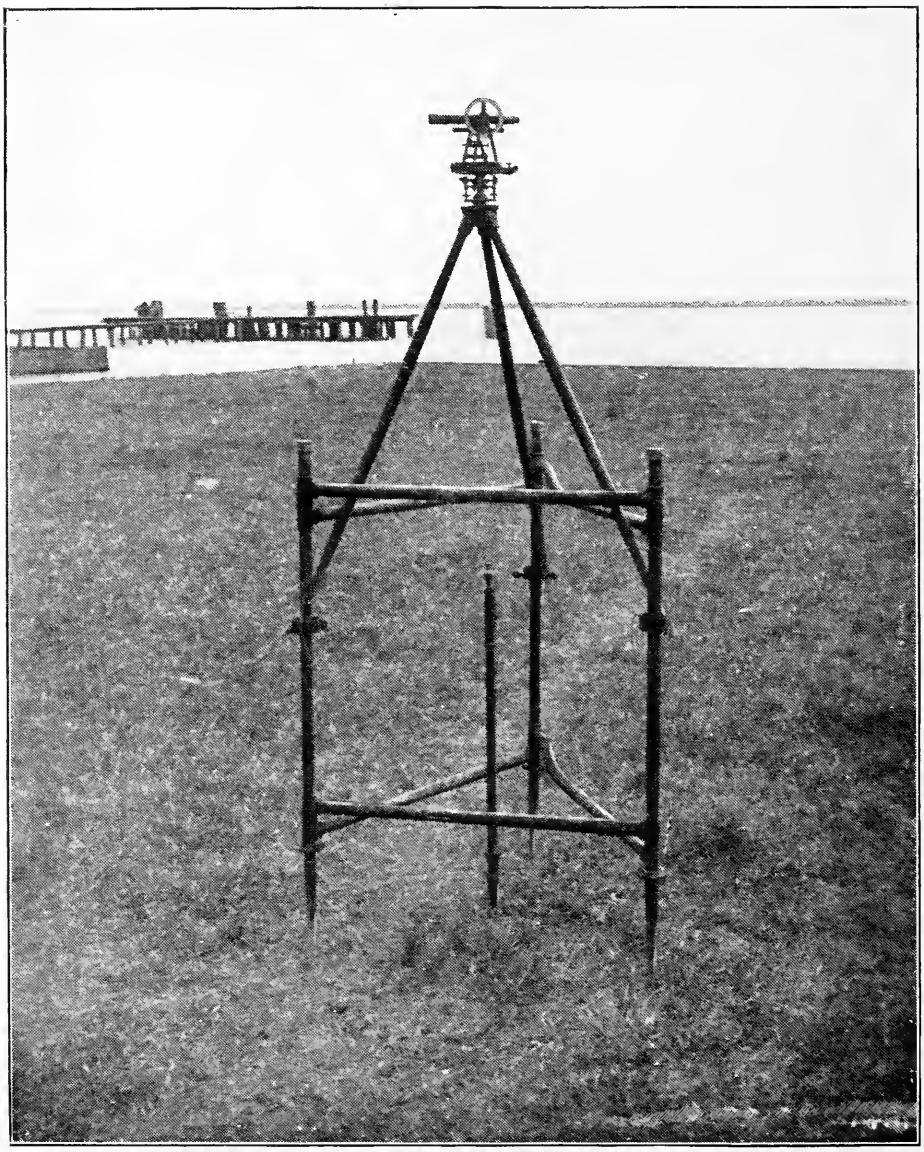

TRANSIT TRESTLE.

REPORT OF CHIEF ENGINEER.

St. Clair Flats, Oct. 15, 1902.

Hon. Edwin A. Wildey, Commissioner of the State Land Office:

Sir—I beg leave to present this my final report of the survey of the St. Clair Flats.

I was commissioned by your predecessor, Hon. William A. French, to undertake the St. Clair Flats Survey under the act of June 23d, 1899, entitled "An Act to provide for the Sale, Disposition and Control of the unpatented Swamp and Overflowed Lands in the Township of Clay, St. Clair County, Michigan." My commission is dated July 26th, 1899.

I began preparations for this work within four days after receiving my commission. Information was gathered and the Flats visited. I soon found that everything required for this survey would have to be taken there from elsewhere,—even to stake timber and kindling wood. The exceptional characteristics of the Flats, the nature of the claims there, and the requirements of the statute, made necessary a survey of an unusual kind. Shelter and subsistence had to be provided, and office accommodations, as well. Quarter boats were used which are described in the report of the Resident Engineer. Instruments had to be set up, and measurements made, as frequently as in laying out lots for a subdivision in a city.

The work was to be carried on over lands that were farm lands at the upper end of the Flats, and that were six feet under water at the Lake St. Clair front, with every stage of wetness between. The hundreds of lots were to be spread over forty or fifty miles of frontage on widely separated channels. The lots were to be of any shape. There were miles and miles of water not over two feet deep. There were square miles of marsh vegetation through which unnumbered lines must be run. There were winds of great severity. Special tools and equipment had to be devised and made to meet the requirements of the case. These are poorly illustrated in the pictures herewith, and are described in the report of the Resident Engineer. His report also covers the details of the field and office work, the organizations of the staff, and the data relating to the extent of this survey.

It was necessary from the very first to endeavor to understand, interpret, and apply the terms and provisions of the statute, in such a manner that our labors and our views would be sustained by the courts. Aided by legal advice an effort has been made to do this.

The statute requires the State Land Office to gather a large amount of information about claims and claimants. As this information was necessary for carrying on our work, we undertook the collection of it. It amounted to hearing and recording the story of every claimant. I considered this so important as to regard it as the key of the whole situation. Events have proved the correctness of this estimate. I presume nothing we have done has facilitated our work in so many ways as our endeavors to find out what the various claimants had to say. All this information has been preserved in the Claim Books and Files which constitute a part of our returns.

No attempt has been made to carry out a preconceived plan, or system, of laying out lots; but the survey has been made to conform to the limits of the claims on the ground, and to the channels, shore lines, and features found there. It is thought this serves the purposes of the act best, as a claim is almost always represented by a single lot number and is

comprised within that lot. With an arbitrary system, or lot plan, the individual claims would have covered all sorts of fractions of such lots, with pieces and fragments, of all kinds, extremely difficult to describe at all, or to mark on the ground, and would have made even a single reference to any claim a very complicated affair. It may be said with confidence that any arbitrary lot plan would have made a second survey necessary under conditions far more complicated than were those we worked under.

While not all of the principles followed were clearly perceived and recorded at the start, the following embraces those we were led to use by our experience on the Flats. Sometimes these are stated in the words of the law, but often otherwise.

1. Lots to conform to claims.
2. But one tract in one claim.—A tract may include more than one lot, or parcel, if contiguous, the whole together forming but one tract.
3. Lay out for each claimant what is claimed and occupied, except it be to conform lines to the general outline, or for some similar reason where some slight increase or decrease may be required.
4. Distinction between claimed and unclaimed lands. Lots laid out differently in the two cases.
5. Sizes of Lots.—Unclaimed land laid out in "Convenient lots or parcels fronting upon said channels, and extending backwards therefrom, and at right angles thereto, a distance of not more than five hundred feet: Provided, however, That no lot shall extend to a greater depth than midway to a parallel channel." No frontage stated.

   Claimed Lands.—Frontage generally to be not over 200 feet. Frontage for clubs may be twenty-five feet per member on the rolls of the club on the first day of January, 1899. Club claims laid out accordingly.

   Commissioner of State Land Office may grant more than 200 feet, in certain cases. Therefore, lots were laid out

to conform to claims. If not allowed and confirmed to claimant, can be subdivided afterwards.

No depth to claims stated in the law. We limited claims to a depth of five hundred feet for uniformity with the rest of the law, to set bounds to the demands of claimants, and to adopt on the start a rule to be applied to all alike.

6. Situation of Lots.—"All of said lands fronting upon the open lake or any of the navigable channels within or bordering upon said lands."

Any navigable channels were taken to include artificial as well as natural channels.

A navigable channel was taken to be one that would sustain the navigation customary in that locality,—that is one that could be traversed by a duck boat.

The lots are situated on and along these channels; on the open lake; and on the boundaries of the reservations for park named in the act.

7. Highways.—These were reserved at convenient points as designated in the statute. On long stretches of shore they were placed about a thousand feet apart, and every two lots on the lake front. Four rods was adopted as a standard width, though not always used. The plats show the actual widths.

"All existing channels and cuts used for passage, whether natural or artificial, extending from either the South Channel, North Channel, Middle Channel, or Snibora Channel to the waters or lands in the rear thereof, are declared to be public highways," and were so treated by being omitted from lots and having lots fronted on them. Highways were laid out across claims.

8. Improvements.—Information regarding the improvements made on claims was gathered and included in the returns. The statute repeatedly refers to the matter of improvements, designating embankments, ditching, dredging, residence, sheet piling, and fencing. In gathering this information an effort was made to cover

TRANSIT SCOW AND TRESTLE.

these items. Other improvements were also found and noted. Such are cultivation, breaking up new land, grading, forming into beds for cultivation, and setting out trees and shrubs.

9. Frontage.—The frontage being the basis of valuation set by the statute upon the lands fronting on the South, North, Middle, and Snibora Channels, I made up these frontages from the detailed sheets myself, independently, and without knowledge of the statements by claimants, or of any other persons, except in one or two instances where a special report seemed called for, in which cases I repeatedly visited the places and considered the cases as fully as I was able to do.

10. Back Claims.—There are many improved claims more than 500 feet back from the South Channel. Generally these are occupied by permanent residents. Such claims were surveyed and marked according to the same general plan followed elsewhere. The same plan was carried out with respect to other lands similarly situated, except those lands occupied as farms southwest of the Private Claims on Harsen's Island. The fence boundaries of these were surveyed and mapped.

11. Permanent Monuments.—The statute provides that permanent monuments be erected at the corners of each of the various and respective lots. Iron pipe was adopted for this purpose, and the lot numbers marked on some two-thirds of these pipes, as appears by the report of the Resident Engineer, and on the detail sheets. The statute calls for numbers to be inscribed on at least one corner of each lot.

Many matters of detail had to be decided upon. Amongst the more important is the system of numbering lots. The entire work was divided into sections which were named, as the South Channel Section, Muscamoot Section, etc. Within these sections the lot numbers are continuous and the same number occurs but once in each section, or division, of the

work. The maps show clearly the division of the sections and the numbering.

The highways are named and not numbered. They are not included in the lots, but set off separately.

The maps are made to show what was land and what was water at the time the survey for any sheet was made.

A title was used that identifies each sheet of maps as a part of the St. Clair Flats Survey.

In the vicinity of Quibel Bay, Middle Channel, was found a considerable area of unsurveyed and unpatented swamp and overflowed lands. Another piece of like character lies between Russell's and Harsen's Islands. By direction of the Land Commissioner, lots were not laid out on these two pieces, although they were surveyed and mapped and the plans for lots completed. With this exception, all of the unpatented swamp and overflowed lands within the delta of the St. Clair river, in the township of Clay, in the county of St. Clair, were surveyed and laid off into lots.

During the progress of this survey we were continually met, from many sources, with numerous questions, objections, and discussions, relating to the ownership of the Flats. It was no part of our duty, under the statute, to entertain these matters. The position taken by us was that such questions belonged to the courts, not to us; that the statute says nothing about ownership; and that we were directed, by the statute, through the Commissioner of the State Land Office, to survey the Flats, whoever might own them.

The details of this survey are set forth in the report of the Resident Engineer, Mr. Fred Morley. No one can read this report through carefully without being impressed with the extent of this work; the burdensome and complicated details connected therewith; and the ability, industry, judgment and foresight of the Resident Engineer, in planning it, carrying it on, and completing it in such a creditable manner. His is a case of that genius which is defined as hard work, united with extraordinary gifts and most extensive and varied experience. I make these statements only as an item of justice,

because to him should be given the principal credit for the results attained.

We were shown every courtesy and given every aid by the U. S. Engineer Office of Detroit, by direction of Colonel G. J. Lydecker, the officer in charge when this survey began. These very agreeable and, to us, useful relations continued after Colonel Lydecker was relieved by Major W. H. Bixby. The same cordial relations existed with the U. S. Lake Survey, under the direction of Major W. L. Fisk. We were furnished with information, maps, blue prints, and whatever could be offered us to aid us in our work. It is a gratification to acknowledge these many kindnesses.

In closing this report, it is a pleasure to testify to the uniform promptness and courtesy with which our wants were supplied by the official representative of the Land Office who was present on the work, Mr. A. C. Carton. The weather was never too bad, the distance too far, or the difficulties too great for him and his men to undertake our commissions. I regret that I am unable to transmit with this a report from him similar to that furnished by the Resident Engineer, as I am sure it would have been of great usefulness to anyone concerned in supplying and subsisting a party of men under similar circumstances.

I take leave of this work and my associates connected therewith with regret.

Very respectfully,

J. B. DAVIS,

Chief Engineer St. Clair Flats Survey.

REPORT OF RESIDENT ENGINEER.

Lansing, Mich., Oct. 4, 1902.

Prof. J. B. Davis, Chief Engineer St. Clair Flats Survey, Ann Arbor, Mich.:

Dear Sir—I have the honor to submit to you the following report of the survey of the St. Clair Flats for transmission to the Commissioner of the State Land Office.

In accordance with your instructions, I proceeded to Grand Point Club House on Tuesday, Sept. 5, 1899, and on the following day accompanied yourself, State Land Commissioner Wm. A. French, State Treasurer Geo. A. Steel, Mr. A. R. Avery, and J. I. Berry, in a preliminary examination of that part of the St. Clair Flats authorized to be surveyed by Act No. 175 of the Public Acts of the Legislature of 1899—returning home the next day.

On Friday, Sept. 8th, prepared to remain permanently at the Flats, I returned thither to proceed with the survey, and awaited. at the Star Island House, the arrival of the quarter boat "Michigan," from Bay City, where it had been fitted out. When this came down the river on Saturday evening, in tow of a tug, I went aboard, and the quarter boat was put into the slip just below the Arthur House on the South Channel. A cook and one man occupying the quarter boat on its way down experienced a rather stormy voyage on Lake Huron.

On the following Monday, Sept. 11, a complete inventory was made of everything aboard or about the Michigan, putting the same in order. At evening three transitmen and one helper arrived from Ann Arbor. Land Commissioner Wm. A. French also arrived with the Scotten house-boat, "Alice May," and tied it up on the bar below the Old Club cottages.

He brought with him one cook and five other men. The next day this house-boat was placed in the cut next below the slip in which the Michigan was lying. Another man was added to the party. You also arrived at evening and remained till the following Saturday morning.

The days immediately following the arrival of these boats were busily spent in preparation for beginning the survey. Materials, already ordered, were being received and other orders sent out. Transits, measuring tapes, transit rods, plumb-bobs, flag-poles, etc., were received and put in readiness. Pipe, to mark the lot corners, must be had. A pipe vice, pipe bench, pipe cutter, pipe wrench and pipe tongs must be provided with which to prepare lengths of pipe for their intended use. Mauls were needed with which to drive them, and when in water, as so many of them would be, a different tool must be devised for continuing the driving to near the bed of the stream or bay. Scythes, axes and corn-knives were sharpened and otherwise made ready.

Besides these more simple preparations, measuring scows must be built for making measurements over water, or from which the men could place and drive pipe corners in water beyond the depth of a hip rubber boot. Then there must be provided transit trestles and transit scows, both of which would frequently be needed in setting up the transit over water and supporting the transitman while using it in this position.

While these preliminary operations were still in progress the field work of the survey was begun on Friday, Sept. 15, 1899, at the lower end of the South Channel by locating a triangle, the vertex of which was in the line of joining the lower with the upper light of the St. Clair Flats Canal, and near the latter and the base on the submerged bar to the westward of the Old Club cottages. This base was measured several times in the water and subsequently on the ice. By it and the measured angles of the triangle or the observed azimuths of its sides the survey was connected with the fixed line between the canal lights by distance as well as by azimuth. The line of this measured base was produced northeasterly to near

the South Channel shore line, and formed, with its prolongation, the first element of the "Traverse Line" referred to later.

From this beginning, the work of surveying out and marking the corners of the various lots or parcels claimed proceeded up the right bank of the South Channel to the Private Claims on Harsen Island.

The line joining the lower with the upper light of the St. Clair Flats Ship Canal, whose azimuth, as furnished by Lieut. Col. G. J. Lydecker, Corps of Engineers, U. S. A., is 221° 06′ 51″, is the initial azimuth line of the survey from which azimuth was extended to all parts of the area under survey, by a system of carefully observed and repeatedly checked azimuth readings of lines which cover the area with a net-work of triangles, quadrilaterals, and closed polygons; the direction of every line of which was observed from each end and found to agree within the limits of the instrument.

The Michigan and Alice May furnished quarters for the party, to which additions were made as the work advanced, and shelter for tools, equipment and provisions, until Nov. 25, when a third quarter boat was added to the outfit. This third quarter boat was also fitted out at Bay City, but on its way down the cabin and everything on board, including stoves, kitchen equipment, bedding, etc., was swept away on Lake Huron, owing to the lateness of the season and the consequent rough seas encountered. The hull, however, was towed to Port Huron, where it was beached and, after being refitted with cabin and furnishings, was brought down the river to us by a small steam launch purchased at Port Huron by the Land Commissioner.

This launch was purchased for use on the survey, but not being suited to the requirements of the work, drawing as it did three feet or more of water, besides being uneconomical in that it required a licensed engineer-pilot to run it, no use was made of it, and it was disposed of at the close of the survey with the rest of the outfit.

What was needed was a launch that could navigate in as little as 18 inches of water so as to cross the shallow bays, pass through the various side channels—always shallow at

their outlets—or run close enough in to shore to enable one in rubber boots to easily wade ashore, and that could conveniently carry 10 or 12 men or tow scows and skiffs anywhere they were needed, and that, whether in use or out of use, required the employment of no skilled or licensed operator. The gasoline launch best met these requirements, and one was used between July, 1900, and October, 1901, whenever needed, at a cost for rent of only $326.25. And this includes the entire cost of such conveyance on the work, excepting ar occasional day's use of a launch prior or subsequent to the period above named, the additional expense of which does not probably amount to more than $50.00.

The hulls of the quarter boats, known as the Michigan and "third quarter boat," were formerly Saginaw river lumber scows. On each of these hulls a cabin was built, divided into four rooms by three cross partitions. The cabins were formed of a light frame work covered on top, sides and ends with matched ceiling stuff and painted outside and inside a light blue. The doors and windows were all provided with screens to protect the occupants from mosquitoes and June flies. The roofs, in addition to being ceiled, were covered with canvas and painted. An additional coat of paint was applied to the roofs as needed from time to time to prevent their leaking.

The hull of the Michigan was 67 ft. long by 16½ ft. wide. The cabin was of the same width, but only 53 ft. long, leaving a deck of 7 ft. at each end. It was divided into an office room 13¼ ft. wide provided with two bunks with four drawers beneath each; a kitchen later reduced to 12 ft. in width, with sink, pump, shelves, tables, a bunk with six drawers beneath, etc.; a dining-room later increased to 13 ft. wide; and a men's quarters 14¾ ft. wide, provided with eight bunks—two in each corner, one above the other. The office and men's quarters were the end rooms.

The hull of the third quarter boat was 61¼ ft. long and 14 ft. wide, the cabin being of the same width, but only 48¾ ft. long, leaving a deck of 6½ ft. at one end and 6 ft. at the other. The four rooms were practically equal in size. The room in the forward end was fitted up as a drawing room.

It was provided with six windows. In one corner were two bunks, one above the other, with four commodious drawers underneath the lower one.

The next room was used, while the field work was in progress, as quarters for the men, being fitted with bunks, but afterward was made a part of the drawing room by removing the partition and bunks and making other minor changes.

The third room was used as a general store room for provisions and tools. The fourth, or room at the rear end of the boat, occupied by the commissary, was furnished as a kitchen, but was never used for that purpose, all the cooking and eating, after the first few months, being done in the kitchen and dining-rooms of the Michigan. This change was brought about at the beginning of the year, and was in every way a better arrangement. It was made possible by moving the partition between kitchen and dining-room, enlarging the latter.

The Alice May was a first-class house-boat, and was rented by the state for the use of the survey. Its hull was 71½ ft. long and 19¾ ft. wide. The cabin was of the same width, but 15 ft. shorter, leaving 7 ft. of deck at one end and 8 ft. at the other. The interior was divided into a parlor across one end of the cabin, while at the other were the dining-room, kitchen, pantry and ice-box—the dining-room occupying about two feet more than half the width of the cabin. The parlor and dining-rooms were connected by a hallway centrally through the boat. On one side of this hall were three state rooms and a combined bathroom and closet, and on the other side three state rooms and a clothes closet connecting with the hall and a servants' closet connecting with the kitchen. The plumbing was such that from a cold water tank on the roof and a hot water heater connected with the kitchen range, both cold and hot water could be supplied to state rooms, wash basins, bath-tub, etc. Upon the approach of cold weather the use of these modern conveniences was discontinued, the pipes drained. tanks emptied, hot water heater disconnected from range, and later on, cooking in this boat done away with. Thereafter the bath-room was converted into a bedroom, the dining-room into an office and drawing room by day and a sitting and read-

TRANSIT SCOW AND TRESTLE.

ing room for the men at night; the pantry into a wash room, and the kitchen into a bath room and dry room for rubber boots and clothes.

With the beginning of the new year I changed my quarters and office from the Michigan to the parlor of the Alice May, and the transitmen then occupied the office in the Michigan, thus moving them from the regular men's quarters and providing them with the much needed place in which to perform the necessary evening work required of them. These changes remained permanent as long as the field work lasted. The use of the Alice May was discontinued after Sept. 28, 1901—it thus having been in commission on the survey two years and eighteen days.

The measuring scows were catamaran in style, each being composed of two scow boats 3 ft. wide and 12 ft. long, placed side by side and united by a decking of 1⅜ inch plank. These planks were 12 inches wide and 9 ft. long. Four of them were placed transversely across the two boats at either end and spiked to their sides, thus holding the pair of scow boats parallel to each other and 3 ft. apart. The remaining middle four feet in length of each scow boat was decked over by four pieces of the same planking cut 3 ft. long, the two middle pieces of which were joined together by cleats on their under side and were not spiked down, though made to fit snugly. By removing these, access was had to the interior of each scow boat for bailing them out when necessary. Thus the deck of a measuring scow was 12 ft. long by 9 ft. wide, with an opening in the middle 4 ft. long and 3 ft. wide. Near each corner of the deck was placed an 8 inch galvanized iron cleat, to each of which was secured by about 32 ft. of ¾-inch rope a 15 pound anchor. On top of the decking were nailed along its edge each way from the corners strips of wood about 3 ft. long and 2 inches high to serve as a protection against slipping off the scow when operating the anchor ropes in freezing weather.

Six of these measuring scows were built and, as their name implies, were chiefly used in making measurements over water generally in connection with setting lot corners in

water through their central well hole, their decks forming a convenient place for pipe and the various tools in use, and for the men to work upon. In actual service on the work they were most conveniently moved forward, when the depth of the water and the hardness of the bottom permitted, by the use of wooden pike poles from 12 to 14 ft. long operated at the sides, stern, or through the well hole by the men, who acquired great skill and dexterity not only in thus propelling them, but in steering them as well. Otherwise they might be propelled by a large sculling oar at their stern, or towed by men rowing in a skiff connected to them by a rope.

When it was necessary to move them, or the transit scows, any considerable distance, as from the quarter boats to a place of operation, or back, they were generally towed by the gasoline launch. I recall one or two instances, however, where advantage was taken of a favorable wind to so move them by a sail temporarily hoisted on them.

On reaching the place at which it was desired to bring a measuring scow to anchor, one or more pike poles were thrust to the bottom of the lake through the well hole and made to bear against the sides or corners of the well hole by a man or two grasping their upper ends. Meanwhile the anchors at the corners are cast as far as possible and the ropes attached to them drawn in and made fast to the corner cleats. By then slacking off on one or more of these ropes and drawing in on correspondingly opposite ones, the scow was quickly secured in the desired position. The well hole being 3 by 4 ft. it was only necessary to bring the scow to within a limit of 1½ to 2 ft. of the exact position of the pipe to be driven. These anchors, while permitting, in connection with the rise and fall of the water, due to passing waves, considerable movement of the scows, held them in place sufficiently to resist the pull of the tape in measuring or to obviate movements inconvenient to the men working upon them, either in the driving of pipe with a maul or otherwise. In setting pipe at given distances apart by means of these scows, two were evidently needed, and in continuous measurement three might sometimes be used to advantage.

Pipes driven from these scows were left with their tops several inches above the water surface to be subsequently driven to near the bed of the lake, bay or stream by the pipe driving party. The buoyancy of a scow was such that even with its load of tools and men the underside of the decking plank was from 6 to 10 inches above the water. This being the case, and the component scow boats being 3 ft. apart, it will readily be seen that no difficulty need be experienced, as was the fact, in withdrawing a scow endwise from around a pipe left as above stated projecting above the water surface. By paying out, for example, the rear anchor ropes while the forward ones were being drawn in, accompanied by a judicious guiding of the scow by a pike pole, the scow was moved forward the distance necessary to bring it clear of the pipe. This being done, the anchors were easily raised in turn by pulling the scow by one of the anchor ropes, at the same time slacking away on the others until nearly over that anchor which then lost its hold on the bottom and was drawn up on deck. The anchors being thus gathered in one by one, unless yielding to an inclined pull, the scow was moved forward to the next position by the pike poles as previously explained.

The pipe driving party, usually consisting of only two men, used one of these measuring scows. With their pike poles they were able to approach a pipe standing with its top as much as 6 to 8 inches above the water surface and bring it within the well hole of the scow without touching the pipe. The while one of them held the scow in this position by the use of two pike poles operated through the well hole, the other threw out the anchors and made fast the anchor ropes to the cleats when all was ready for the driving.

The sides of the scow boats composing the measuring and transit scows were made of thoroughly seasoned white pine planking dressed to 1¾ inches by 12 inches by 12 ft. The ends of these were given a bevel of 24 inches horizontal to 8 inches rise, thus leaving 8 ft. of horizontal bottom and 4 inches of vertical end. To form the bottom, including the beveled ends, clear, kiln dried, white pine lumber, dressed on both sides ⅞ inches thick, from 6 to 8 inches wide, cut to 3 ft.

lengths, were used. The ends were made of 2 by 4 inch stuff cut to a suitable length to go between the sides.

The bottom boards were carefully nailed to the edges of the plank sides. A rib of dressed 2 by 4 inch stuff extended the whole length of the bottom, including the beveled ends, to which the bottom boards were also nailed. No calking was employed in any of the joints. Two methods were used in making these joints. In one the edges of each bottom board were planed to straight surfaces or jointed but with a slight bevel. They were then placed so that the edges just touched, leaving a V-shaped crack between them, opening outward, and were then nailed in this position. The nails were set in two rows and staggered. When placed in the water these joints swelled shut and made a water-tight joint.

In the second method, the edges of the bottom boards were planed to straight surfaces as before but not beveled. A depression was then made centrally along the entire length of the edge by pounding on a short length of round rod applied longitudinally to the edge. The portion of the edge on either side of the depression thus made was now planed off. Thus prepared, the bottom boards were placed side by side as before and nailed in position. The lower edges of the side planking were treated in the same manner. Thoroughly water-tight, self-calking joints were in this manner secured.

During the two years in which these scows were in use they gave no trouble from leakage. Of course, they occasionally required bailing out, mainly of water that had entered through cracks in the top decking, from the rain or waves.

Each winter when ice began to form all scows and skiffs were hauled out, to be returned to the water at the opening of spring. The measuring scows were turned over and placed one above the other to the number of three in a tier. This could not be done with the transit scows, as will be seen from their construction, but care was taken to remove the water from them.

It was frequently necessary to set up a transit over water and make observations from it. This required a stable and at the same time an adjustable support for the transit, and

secondly a platform surrounding, but separate from, the transit support on which the transitman could stand and have convenient and even comfortable access to his instrument from all sides. The latter requirement was met by what was called a transit scow. Two of these scows were built. They resembled in construction the measuring scows, but were larger, being composed of two scow boats each 4 ft. wide and 12 ft. long, placed 4 ft. apart, thus providing a platform 12 ft. square in which was left a central well hole 4 ft. square, through which the transit support, described below, was lowered into position.

Anchors at the corners, such as were used on the measuring scows, would be wholly inadequate to give that stability and steadiness required in a support of the nature intended. These scows were, therefore, supplied with spuds at the corners—anchors not being used. An oak post 4 inches square by 3 ft. long was placed at each corner of the decking with its outer faces flush with the side and end of the scow. The lower end of a post was secured to the scow by an iron strap ¼ inch thick, 1¾ inches wide and 4 ft. long, countersunk into and nailed to the front face of the post and passing down under the scow outside of the bottom boards through which it was secured to the side plank by nails. The top of a post was held by two wooden braces in planes at right angles to each other—one running to the middle of the side of the scow and the other to the inner end of a scow-boat, the latter brace being countersunk into the post. The spuds were straight seasoned oak timbers 4 inches square and 12 ft. long, surfaced on all sides. In position they were in front of the short corner posts which served as guides to them, and to which they were held by two square cornered U loops of iron ¼ inch thick by 1¾ inches wide, which embraced the spuds and were screwed to the posts, one at the top and one at the bottom, the latter being also secured to the decking. The spuds were thus held perpendicular to the deck without being restricted from movement in the same direction. When not in use, each spud was supported on an iron pin thrust through a hole of corrsponding size in the spud near its lower end and resting on the

lower iron strap. The withdrawal of this pin permitted the spud to descend into the water of its own weight.

A 1 inch rope, about 22 ft. long, passing through a hole bored through a spud near its lower end in a direction perpendicular to the sides of the scow, its two ends being brought up over the corner post braces and spliced or tied together, furnished a convenient means of raising a spud by simply pulling up on the two parts of this rope.

For throwing the weight of the scow more or less on the spuds, as may be desired, in order to secure the requisite steadiness, after they have been let down to the bottom, each spud was provided with a tackle consisting of one single sheave 4 inch steel block with eye and hook, one double sheave 4 inch steel block with hook only, and about 32 ft. of $\frac{5}{8}$ inch rope. Immediately behind a corner post, i. e., opposite a spud, was placed a strap eye with a strap fastened to the inner face of the side plank of the scow and the eye projecting above the deck into which the single sheave block was hooked. In the top of a spud an opening was cut into which a rope loop, about 6 inches in diameter, was placed, and to which the double sheave block was hooked. The free end of the rope connecting these blocks could be made fast to a 6 inch galvanized cleat on the inner face of the corner post near its top.

It will be seen that this arrangement quadrupled the force applied and it was possible by this means to so raise the scow as to throw a large part of its weight on the spuds. The great steadiness thus secured was further increased by inserting wedges between the spuds and the iron loops by which the spuds were held in sliding contact with the corner posts. These wedges were particularly useful when considerable wave undulations disturbed the water surface.

Two transit supports were provided—one for each transit scow. These were equilateral triangular iron trestles built up of ordinary iron pipe united by plain and tee screw couplings. A few other fittings were also made use of in their construction.

Each trestle consisted of three upright pieces or legs joined

together near the bottom and near the top by a horizontal equilateral triangular frame, one side of which was a single piece of straight pipe; a second side was composed of two pieces of straight pipe—one short and one long—joined together by a right and left hand plain screw coupling, while the third side had a vertical reverse bend of about 3 inch rise near one end, these modifications being for the purpose of facilitating the putting together of the various parts of the trestle. The sides of these horizontal frames united the uprights, two and two, by being screwed into the horizontal branches of the tee couplings on the uprights.

Each upright piece, or leg, consisted of the following parts, named in the order in which they occur in a complete trestle from the top downward: A pipe cap, a pipe nipple about 5 inches long, two tee couplings united end to end by an interior short piece of threaded pipe, a 3 ft. length of straight pipe forming the leg proper, two more end to end tee couplings united like the upper two, a common floor plate, and a 16 inch length of pipe pointed at the lower end by welding a piece of steel into the open end of the pipe.

The floor plate was four inches in diameter, and was screwed down over the upper end of the pointed pipe before it was screwed into the lower tee coupling. These floor plates were for the purpose of preventing the trestle from sinking too far into the mud, silt, or sand, into which the points penetrated as the trestle was let down onto the lake bottom and forced to a solid bearing, usually by a person standing on the upper horizontal bars.

The feet of the tripod of the instrument, when set up on the trestle, rested in cups embracing and capable of moving freely up or down on the iron legs of the trestle—one on each leg. A cup was made from a blank pipe reducer by boring a hole centrally through its circular disk large enough to permit its sliding freely on the trestle leg—the rim of the cap being set upward to form the cup. Near the upper edge of the rim two small holes were bored through it opposite each other, into which the ends of a cord, which passed up over a horizontal bar of the trestle, were tied, whereby the cup

could be drawn to the surface if, for any reason, it had slid down the leg out of reach. A thumb screw inserted radially into the disk part of the cap served to clamp it at any desired height on a trestle leg. These cups were of such a size as to leave somewhat more than an inch between their rims and the trestle leg.

The trestle above described could be used in water up to 3 to 3½ ft. For greater depths, up to 5 or 6 ft., a second section, or bent of trestle, identical in construction with the first, as far down as to its lower pair of tee couplings, including the cups, was placed above the first by screwing its three 3 ft. uprights into the tops of the upper tee couplings of the first, after having removed from them the capped nipples. This change of length of trestle was quickly made.

One of the two complete 6 ft. instrument trestles used was made of ¾ inch pipe, which was found rather light, and the lower section of it was stiffened by wire diagonals placed in the side rectangles formed by the legs and horizontal bars. The width of a side of this trestle, out to out, measured 46 inches. The second complete trestle was made of 1¼ inch pipe and was very stable. Probably if both had been made of 1 inch pipe every requirement would have been met.

In the use of a transit scow, one of these trestles was placed upon it. More commonly it was required to set up a transit over a pipe already driven, but with its top still several inches above the water surface. The placing of a transit scow so that such a pipe would occupy a position in the center of its well hole without in the operation hitting the pipe, was accomplished by a dexterous use of pike poles in the hands of the men by which the scow was moved forward, so that the pipe passed between its two scow-boats and under the decking between them. When the pipe appeared in the well hole, two pike poles were thrust through this hole, if not already there, to the bottom, and made to bear against the sides of the well so as to bring the pipe in the center of the hole and hold it there during the few seconds required to let two (usually opposite) spuds descend to the bottom. No anchors were used. All the spuds were then lowered and the scows hoisted par-

TRANSIT SCOW AND TRESTLE—PLUMBING UP FROM A PIPE.

tially out of water, by the corner tackles, and, if necessary, the spuds wedged, as elsewhere mentioned. The trestle was then lowered in the well hole, with the pipe central to it, and pressed down to a solid bearing, the cups clamped near the surface of the water, the tripod legs set in them, the instrument put on, and the plumb-bob made to occupy nearly its proper position over the pipe by raising or lowering one or more of the cups as found necessary. The shifting head of the instrument was then used, as on land, for exact centering. Several of these operations might be going on at the same time. To enable the observer to get close to his instrument, one or more pieces of planking were placed across the well hole between the tripod legs.

In measuring over water, supports of the tape, intermediate between measuring scows, were generally afforded by one or more skiffs anchored on line between them.

It was a simple operation to move a transit scow from around a pipe. The trestle was first raised on deck and laid on its side across the well hole, then the spuds raised and the scow guided forward by the use of pike poles.

It was necessary to drive all pipe corners, whose location brought them on water of more than a few inches in depth, down to near the bed of the lake, bay or channel in whichever they chanced to be.

Had this not been done, it is safe to say, most of them would have been seriously disturbed or wholly destroyed during a single season. For had they escaped the destructive force of floating ice cakes in the late fall or early spring, driven as they are by the winds, and often piled in winrows along the shores, they could hardly have escaped the resistless flow of the ice gorges plowing their way down the channels, and laterally out through every side cut and outlet, taking everything before them to the very bottom, or the gradual though none the less forceful and destructive ice shoving movements at times of temperature changes; or escaped being lifted from their positions with every vertical fluctuation of water level in the dead of winter.

Then, too, it was necessary to drive these pipe, not only for

their own safety, but also to guard against accident and injury to small boats and launches which, in the resort season, ply all parts of these waters at almost all hours of day or night.

This driving was rapidly and very satisfactorily accomplished by a tool, especially devised for this purpose, and known on the work as "the driver."

The body of this driver, or follower, was made of extra heavy hydraulic steel pipe, having a 2 inch internal and a 3 inch external diameter and, therefore, weighing about 13 pounds per lineal foot. To meet the varying requirements as to depth of water, or resistence to driving, it was divided into three lengths, two of which were each 54 inches long and one 24 inches long. The ends of each length were true right sections of the pipe, and were provided with internal screw threads. Any two lengths were united by a solid coupling piece, the central 2 inches in length of which was of the same external diameter as the pipe, while the end parts were turned down and screw threads cut on them to fit those in the ends of the pipe. One of the longer length served for driving pipe corners in water up to about 4 ft. in depth, unless more weight was needed on account of resistance met with. In water deeper than this, one or the other of the two remaining sections was added.

The lower end of the driver was terminated by a solid steel shoe 3 inches in diameter and 2 inches long screwed into it, as was the coupling. The lower face of this shoe was turned in a lathe to a slight re-entrant conical surface, and from its center there projected a 1 inch steel pin, or shank, 18 inches long terminating in a point. In the operation of driving a pipe, this pin was inserted into the pipe to be driven and served to guide the driver in its churning motion, while the conical surface of the shoe had a tendency to prevent the pipe being driven from splitting or brooming outward under the blows it received. In the top of the driver was inserted a strong wooden plug, forked at its upper end by a slot about 1 inch wide and 3 inches deep. To each end of a suitable

length of ¼ inch chain was attached a bitch link, by the aid of which a loop was formed at each end of the chain and passed around the pipe of the driver—one loop above the other, but both near its lower end, while the remainder of the chain was brought up along opposite sides of the pipe and passed through the fork of the wooden plug at the top. A few blows of a hammer or even from the foot served to tighten the loops about the pipe of the driver so that they would not slip, and any force applied to the chain only served to increase the grip of the loops. To complete this tool, a wooden handle-bar 5 ft. long was made. The shank or middle foot in length of this handle-bar had a section 5 inches wide horizontally and 3 inches thick, and the ends were dressed down to form 2 inch round handles. Suitable holes made through the center of this handle-bar permitted it to be slipped down over the pipe of the driver and the chains at either side, and two common wire spikes, inserted through horizontal holes in the handle-bar and the links of the chain, enabled the handle-bar to be fixed at any position along the length of the driver, or quickly changed from one position to another.

The operation of driving pipe with this tool was as simple as it was satisfactory and rapid. A driving party consisted of two men. In open water they operated from the deck of a measuring scow. Having anchored the scow so that the pipe to be driven appeared within the area of its well hole, preferably near one corner, the depth of the water was taken with a measuring stick and noted or marked on the driver. The driver was then raised by its handle-bar, its pin or point inserted into the pipe to be driven, when a vertical churning motion, given to the driver by the men—one at each end of the handle-bar—quickly settled the pipe to place. As the pipe descended the handle-bar was raised so that no back-aching position had to be assumed.

The churning motion of the driver, owing to its uniform section, produced very little disturbance in the water. With the range in size of pipe used for corners this section could not well be less than 3 inches in diameter, and 13 pounds per

lineal foot of driver met all requirements as to weight. These considerations made a hollow tube preferable to a solid cylinder in its construction, though probably more costly.

The height to which a pipe was left projecting above the bottom depended somewhat on the depth of the water and the exposed position of the pipe. This height varied from a few inches in shallow water to as much as a foot in the deeper parts of the bay crossings. When working on the ice, the driver was hauled from pipe to pipe on a sled, the method of operating it, however, remaining the same. Sometimes in shallow water, where the driving proved to be easy, particularly in positions where the men could stand on the bottom, or the scow could not be brought, a pipe was driven without the driver, by churning a selected piece of ordinary pipe upon its top, the blows being guided by an iron rod within it of smaller diameter, inserted vertically into the top of the pipe to be driven and prevented from descending too far into it by ramming in a wad of rushes.

This selected pipe and rod formed a part of the pipe driving men's outfit for occasional use in such cases as are indicated above.

Whenever the pipe driving party was sent out for a day's driving, they were furnished with a working map, showing the position of the pipe in the field, etc., on which they checked off such pipe as were driven and returned the map to the office.

The plan followed throughout the work, of driving such pipe as came in the water at the time they were set by the transit parties only to within a few inches of the water surface and leaving them in this position until all the work of setting pipe, taking topography, checking the work by computation, etc., in any particular locality was done, before further driving by the regular pipe driving party, rendered it rarely if ever necessary to set up a transit over a pipe that had been driven to the bottom in water of any depth. In making the Muscamoot Bay, Goose Bay, and Anchor Bay crossings, an exception was made to this in that the driving party closely

followed the transit parties engaged in setting the pipe and continued the driving of the pipe to below the water surface.

All lot corners, traverse line angles, azimuth, or triangulation, angles, or other points of the survey, were marked by iron pipe. A few of these pipe were 1 inch, but most of them 1¼ to 2 inches in diameter, known to the trade as second-hand pipe, furnished in various lengths and cut on the work into lengths suited to the character of the material into which they were to be driven, such lengths being used as would, when driven, stand securely. As set, the pipes range all the way from 4 to 12 ft. in length. The shorter lengths were used in water where they would be driven down in hard sand bottom. Occasionally longer lengths than 12 ft. were put in. Pipes driven on land were left projecting a foot or more above the ground. In hard driving, the tops of the pipes broomed some under the blows of the iron mauls, but not objectionably. A record was made in the field books of the length and diameter of each pipe as driven, and, when in water, of its depth also.

Pipe set in laying out the controlling lines of the work, as, for example, at the angles in the front line of lots, were plumbed in two directions, as driven, by the use of a plumb-bob. In laying out lots, pipe corners, set on a given line, at a given distance from another pipe on the same line, were plumbed, as driven, in one direction by the vertical cross-hair of the transit, and in a direction at right angles to this by a plumb-bob. Pipe corners set at the intersection of two transit lines, as many of them were, were plumbed as driven by the vertical cross-hair of each transit.

The lot numbers were marked on the pipe with a prick punch, the marking being sometimes done before a pipe was driven and sometimes after, as necessity, convenience or rapidity, in prosecuting the work, dictated. It was not unusual for a transit party to lay out a number of lots and then go back and mark the pipes. In such a case the transitman marked the numbers on a pipe with an iron-worker's crayon, and was followed by one or more prick-punch men and as-

sistants to indent the markings. A record was kept in the field books of all pipe markings, the same being also shown on the maps and tracings.

The head of each transit party was provided in advance with a working map of the lots, whose corners, etc., he was to locate on the ground, showing sufficient dimensions, azimuths, etc., to enable him to do the work, as well as showing what corners were to be marked and the numbers to be put on them. In general, the front corners only of lots wholly in water, as on the various bay crossings, were marked. Lots facing on the main channels had their rear corners and traverse pipes marked. Lots on other channels had their rear corners and intermediate side line pipe marked. A conservative estimate, based on an actual determination of the percentage of pipe marked to the whole number of pipe set on one of the main channels, would place the whole number of pipes marked as two-thirds of the whole number set. Each pipe generally bears at least two numbers, and not unfrequently three or four, with from one to three (mostly three) figures in a number.

The iron pipe used for lot corners, etc., furnished a secure, convenient and accurate means of supporting and centering flag poles. Poles up to about 6 ft. in length plumbed and wedged into a pipe, would so remain for a long time, through many gales, thus saving much time and annoyance. Poles higher than this were either braced or guyed with wire, and were not so secure against the fierce gales, being frequently leveled to the ground. In winter, when the flag-poles froze in the pipes, a bunch of marsh grass placed around a pipe, or a rag, saturated with a little kerosene, wrapped around the pipe, and ignited, soon loosened the flag-pole. Pounding on the pipe sometimes accomplished the same end.

Flags were either fixed or free, and were made of white and red cloth, singly or combined. Observations made over distances of two to five miles in length, were usually made upon fixed flags composed of a center white strip between two red ones. The atmospheric conditions at the Flats at all seasons

are exceedingly unfavorable for sighting over distances of any length.

The luxuriant growth of rushes, canes and marsh grass made it necessary to cut out a very large percentage of the lot and traverse lines. This was done on the land and ice or in water within the wading limits of hip rubber boots by mowing a swath in the usual manner with a scythe. Otherwise it was done from a skiff with one man at the stern guiding and pushing the boat forward, while a man at the bow with scythe or corn-knife, cut out the line—not an easy operation. Autumn prairie fires kindly assisted in this work, but only to a very limited degree. Sometimes, in winter, the lines had to be cleared of snowdrifts also.

All measurements were made with steel tapes. The tapes universally used were 500 ft. long, with graduation marks every 50 ft., excepting that every foot was marked for the first 10 ft. A 25 ft. steel tape, graduated to hundredths, was used in connection with each 500 ft. tape to measure the pluses. All tapes were necessarily on open reels. In making measurements with the 500 ft. tapes, excepting in occasional long distance measurements, where the entire length of tape was made use of, the part of the tape not needed for the measurement was left on the reel—the reel being used as a handle by the head chainman. In other words, only so much of a tape was unreeled as any particular measurement required.

In setting a pipe at a given distance from another not marked on the long tape, the plus was first marked on the tape with a soft lead pencil and tape reeled in to that mark. While the pipe was being driven, its position for distance was tested by repeating the measurement.

In measuring a distance between two pipes already set, the measurement was taken from center to center of the pipes between the zero of the tape held at one center and a pencil mark made on the tape at the other center. The plus of the pencil mark was then taken with the 25 ft. tape.

In measuring long distances, the successive lengths were

marked by spikes set at the forward end of the tape or under a plumb-bob suspended from it. These spikes served also as tally pins. In soft places a transit rod might be used in place of a spike. These distances were usually measured twice.

It was the duty of a head chainman to clean and oil his tapes each evening to keep them free from rust.

The 500 ft. tapes furnished were rather light for the severe strains put upon them, and frequent breaks occurred either in the body of the tape or by the end knobs pulling off. These were mended on the work. In order to preserve the length of the tape unchanged, a break anywhere between end graduations required a splice piece in its repair. Briefly, a splice was made as follows: Near the end of each of the two pieces to be joined, a pair of opposite rectangular notches were filed into the edges, all four notches being of the same size and depth. The side surfaces to be joined were then made clean by filing, a small quantity of Burnley soldering paste applied to each piece, one of them held over an alcohol flame and solder applied to it, the second piece then put on the soldered side of the first and held accurately in place, while a pair of pliers pressed them together and held them till cool. Any superfluous solder was then filed off, especially at the notches and fine copper wire wrapped around both pieces for the length of the notch. A little more paste was then put on, and solder applied to the wire over the flame, being careful in this last operation not to unsolder the two pieces of tape joined in the first soldering. Any extra solder was then filed off, and a strong joint resulted.

As the front lines of lots bordering on the main channels would come in the water, and, in some cases, the back lines of such lots also, it was evident at the outset that the work of laying out such lots, as well as carrying on the survey in general, would be greatly facilitated, and its accuracy increased, by running a broken line along and near the front shore lines on the highest and firmest ground, usually in front of the cottages, to serve as a base line for the detail work of laying out lots, and a frame work or skeleton uniting the

MEASURING SCOW.

whole. Such a line was, therefore, run, and is designated in the record books and on the maps as "Traverse Line."

Whenever possible, its intersections with the side lines of the lots are marked by iron pipe, on which the lot numbers are placed. These traverse pipes and the back corner pipes of the lots, being in general both on the land, furnish two easily accessible and comparatively secure marks on the side lines of the lots for the convenience of claimants and others in identifying their boundaries.

Where the front corners of lots facing on the side channels also come in the water, pipes called "intermediate" were set back from them on the land. These pipes being on the side lines of the lots and marked with the lot numbers, assist, like traverse pipe, in the identification of the boundaries of such lots.

The component lengths of the traverse line were made as long as local conditions would permit. Taken in connection with the front lines of lots of the various bay crossings, certain Private Claim lines, and other measured lines, they form closed circuits for computing and checking the accuracy of the work. Where possible, the stations used in extending the azimuths over the area under survey, were made angles in the traverse lines.

These traverse lines, the front lines of all lots, whether fronting on the main channels, side channels, or the open lake, as in the bay crossing sections, the side lines of all existing highways, and all the azimuth and triangulation stations, were located by the planning party consisting of myself and two assistants.

I also read the azimuths of the many component lines of the traverse line, and of the more numerous lines composing the front line of lots along the main channels (except four on the north side of the North Channel), the azimuths between corresponding traverse and front line angles between traverse angles on opposite sides of the channels and the azimuths of the net work of general triangles covering the area of the survey, as exhibited on the General Azimuth Map, and the azimuths observed in connection with the resurvey of the

Private Claims on Harsen Island, as well as the angles of all the triangulation work done. These azimuths and angles required over 6,800 careful pointings of the instrument, and nearly as many careful double readings of the plates. The extreme care required in these observations and readings, in order to secure the gratifying results obtained, can only be appreciated by one familiar with such work in general, and with the St. Clair Flats in particular. The unstable and yielding condition of the ground, the even less stability oftentimes of the ice, the almost continuous blowing of the winds, the radiation, the haze, and even the movements of the water, in one to two feet of which the instrument had to be set up many times, and the necessity of prosecuting the work at all seasons of the year, made the task of extending the azimuths to every part of an area not less than 40 square miles in extent one of exceptional difficulty. The instruments used were Buff and Berger Transit No. 1306, and Berger & Sons Transit No. 3241. Both instruments have 4 inch circles reading to 30″, and were read to 15″.

Ordinarily, preliminary to and forming an essential part of a survey of the extent and character of the present one, an exact triangulation, with precise measured base and closely measured angles, would have been spread over the area to be surveyed. To have properly made such a triangulation in the present case, would have required a considerable amount of time and correspondingly incurred expense, owing to the exceedingly rare atmospheric conditions favorable for such angle readings between lines passing, as these must, over and close to alternate stretches of land and water composing the "Flats." For various reasons such a triangulation seemed out of the question. Chief among these was the lack of time for planning it, and observing its angles in our efforts to push the details of the work and to complete the survey in the shortest time possible in accordance with the wishes of the two Land Commissioners.

As a substitute for such usual triangulation, the following plan has been carried out, which, while involving practically no extra time or expense, has resulted in a system of general

triangles, shown on the map of General Triangles, the accuracy of the mean coordinate results of which is believed to be but little inferior to a triangulation proper—certainly of sufficient accuracy for the purposes of this survey and believed to be equal to careful chaining over level ground with a 500 ft. tape.

The direction of all lines of the survey were read as azimuths. In the regular work of reading the azimuths of traverse lines, front lot lines and other general lines and in extending the azimuths from channel to channel over the "Flats" for the use of the transit parties engaged in the detail work of laying out lots, my practice was, while occupying important stations for these purposes, to also read the azimuths to other important visible stations. In this way the system of general triangles was gradually developed, as the work progressed, whose angles were determined from the azimuths of their sides. These azimuths were read to the nearest 15 seconds of arc as stated above. To insure accuracy in extending the azimuths from one part of the Flats to another, the azimuths were carried by closed polygons, and all azimuths of the sides of the triangles used were read in both directions. The azimuths of some of the lines were read several times, not only from the same end but from opposite ends. When occasionally slight differences occurred in them their mean was taken as the adopted azimuth. It is believed that the angles of the triangles, as obtained from these aximuths, are in general within 8 seconds of their true value,—a belief based on a comparison between the values of angles as obtained from their direct measurement by repetition, and their values as deduced from the azimuths of their sides in another part of the work, and from the closeness of agreement of the measured length of certain lines with their length as computed through a series of triangles with angles determined from the azimuths of their sides.

Several of the sides of the large triangles were measured in winter on the ice. In the computation of the general triangles the measured distance from station Heikes to station

Wellington is used as the base and the other measured distances serve as a check on the accuracy of azimuth readings when compared with their computed values.

In these computations where more than one value of any side of a triangle was obtained the mean of the slightly varying results was adopted. The co-ordinates of all stations adjacent to any given station were then computed with reference to that station. Finally, taking station Fisher (which is also at the center of the entire work) as origin, the co-ordinates of all other points of the general triangulation were computed with reference to it from the co-ordinates between adjacent stations by passing from station Fisher to the other stations, in general, over different routes and taking the mean of the slightly varying results as the final co-ordinate of any station with reference to station Fisher. These final co-ordinates were used in plotting the points of the general triangulation on the General Map, which points in turn served as origins for plotting the points of the various adjusted closed polygons.

The field operations were carried out by what might be called a planning party, several transit parties, a pipe driving party, and a topographical party.

The regular work of a transit party was to lay out the lots in accordance with the controlling lines laid down, instructions given and working map supplied it by myself. It consisted of a transit man in charge who did all the instrumental work, except lining in with a second transit when setting pipe by intersection, and kept all the records, and in general four assistants—two chainmen and two helpers.

The pipe driving party, operating "the driver" previously described, were the assistants of the planning party, detailed to do the driving, for which they were especially fitted on account of their general familiarity with the location of all parts of the work.

The topographical party, when not engaged in topographical work, formed one of the transit parties. When taking topography it consisted of the observer or transitman, a recorder, and, generally, two or three stadia men and a helper.

It was instructed to locate all shore lines, and other natural features, including, in certain places, edges of rushes, and to determine the location and extent of all improvements as enumerated in the act, such as ditches, dredge cuts, dredge dumps, limits of raised ground, limits of cultivated ground, fences, sheet piling, docks, club houses, hotels, cottages and other buildings and structures.

No elevations were taken, the plan alone being determined. As the topographical work followed the work of laying out lots, the topographical instrument stations were chosen on convenient pipe corners, thus rendering it unnecessary for the topographers to "carry" their azimuth for any work within reach of such corners.

Whenever it was necessary for them to "carry" their azimuth, as, for example, in the circuits around the upper end of Muscamoot and Goose Bays, it was carefully checked in the field by either closing the circuit or closing on a line of known azimuth. In important stadia circuits the distances between instrument stations were measured with the tape and not by stadia readings.

Some idea of the extent of the topographical work can be formed from the fact that over 29,000 instrument "pointings" were made in its execution. All the topographical work was done with Buff and Berger instruments, furnished by the University.

It fell to my lot, also, to interview the various claimants to lands on the several channels, excepting some twenty at the lower end of the South Channel. To this end written notices were sent to them to which all responded, either in person or by letter, and the pleasure of meeting so many courteous people will linger long in my memory. By going over a claimant's lot with him he could point out the bounds of his claim on the ground—information it was necessary for me to have before proceeding with the survey as obviously the lines between claimants as laid down by the survey should conform, as far as possible, with the lines of *occupation*. At the same time a full statement was also obtained from each claimant as to his improvements and their value.

the time and conditions of his occupation, whether there were contestants to his claim, or whether he was interested in other claims, together with his name and post-office address. It was not always easy to learn who the claimant to some of the property really was, particularly where the improvements were meager, often requiring diligent inquiry and considerable correspondence.

Where claims overlapped, as a few of them did, or where the boundary lines were in dispute, an effort was made to secure an amicable settlement before proceeding with the survey.

Where persons could not appear in person, or by proxy, the necessary information was obtained by correspondence, which reached burdensome proportions at times.

To obtain this information far enough in advance of the field work, to enable me to place temporary marks in the field in accordance therewith for the guidance of the transit parties in setting the permanent corners of such claims, required forethought and a liberal allowance for contingencies, particularly at such seasons of the year as a trip to the Flats, if not absolutely impossible, was more one of hardship than of pleasure.

These claimants, on all channels, number 660. The information obtained from them in regard to their claims was put in permanent form and constitutes the four "Claim Books" forwarded to the Land Office for future reference and use in the settlement of claims.

Before the work on the South and Middle Channels could be closed on the lower end of the Private Claims occupying some 3,300 acres, or more than five square miles of land, at the head of Harsen Island, it was necessary to restore and mark the boundaries of these claims, which are five in number, and were surveyed in 1828, at which time the notes show their corners to have been marked by "a stake and mound." They are, in general form, strips of land less than one-half mile in width, extending from the North Channel, southwesterly, about two and one-half miles in average length. These claims embrace all the territory between the South Channel and the

Middle Channel, including two strips reserved for highways, only one of which, however, has been opened to travel, each one chain wide, situated respectively between the first and second and between the third and fourth claims from the South Channel. These roads are particularly mentioned in this connection, because the records of these early surveys fail to give any connection, either by a distance or bearing between claims on opposite sides of either of the roads—an omission which it will be seen might easily complicate or materially increase the work of restoring the lines of these claims in case a sufficient number of original corners could not be found for restoring, independently, claims separated by these roads.

The recorded connection, found in the field notes of the early surveys, between these Private Claims and section corners on the north side of the North Channel, were thoroughly investigated,—a full discussion of which will be found in Field Book No. 43.

The work of restoring these claim lines was entered upon by obtaining copies of deeds bearing upon the subject, by consulting many of the most reliable residents and other persons having a knowledge of these claims, some of these persons being now seventy to eighty years old and reared on the island; by going over the claims with a number of these early settlers, for the purpose of having them point out to me the location of such landmarks as they knew, and give their testimony in regard to them, and in other ways collecting information bearing on the subject. This was followed by preliminary measurements and a diligent use of the pick and shovel, testing and verifying the evidence gathered, and adding thereto as the work progressed, and finally laying down the lines and monumenting and witnessing the re-established corners.

A large amount of labor was necessarily expended in this work, but I am gratified to state that a sufficient number of the old landmarks were found, and their correctness established beyond doubt, to enable the restoration of the whole to be accomplished to my entire satisfaction—the restored lines fitting admirably the part of the island to which they apply,

as it exists today, with allowance in a few places where evident changes have taken place, which add to, rather than detract from, the confidence felt in the result.

This work was mainly done by myself, with a couple of assistants and occupied about two months of time, during the months of July, August and September, 1901.

There was also a Private Claim on Stromness Island, fronting on the Middle Channel, whose lines and corners had to be restored in like manner. This claim was about one-third of a mile wide and two and one-quarter miles long extending to Goose Bay across the marsh, and containing about 515 acres.

The long side lines had to be cut out with scythes through the tall marsh grass and cane. Monuments were placed on these side lines about 1,500 ft. apart. In the early survey of 1828 this claim was connected with the claims on Harsen Island. After restoring this connection and starting the southerly side line of the claim, the remainder of the work was done by one of the transitmen, with two or three assistants. The sixteen monuments placed on the side lines of this Private Claim, it is believed, will preserve their location for many years to come. Each monument consists of an iron pipe driven well into the ground and projecting several feet above it, with a mound of earth raised around the pipe. Within the mound a quantity of lime, charcoal and brick are deposited. This work was done in August, 1901. The work of restoring the lines and corners of all the Private Claims will be found fully recorded in Field Books Nos. 41 and 43. These claim lines being restored, the surveys of the South and Middle Channels were then closed upon them.

Perhaps the most difficult part of the whole survey was to re-establish on the ground the U. S. Government Meander Line of 1818 on the north side of the North Channel. Every trace of this meander line had disappeared, long since. It originally started from a Lynn tree, on the north shore of Anchor Bay, at that time a corner of an old Chippewa reservation, but now gone, and some four miles from the locality on the North Channel to where the restored meander line would be needed. It passed from this tree, southeasterly, southerly,

MEASURING.

and southwesterly along the bay shore, nearly to the North Channel; thence around the horn-like point of land dividing the bay from the channel; thence up stream along the north shore of the channel to one corner of a Private Claim. Not only were the corners of this private claim gone, but also every trace of section or township lines closing on it. This meander line passed through parts of two separate townships, and was about six and one-fifth miles in length. Except in one instance, near its beginning, it was not connected with any section line. Indeed, not a township or section corner exists today in either township, south of the initial point of this meander. Evidently, then, any attempt to restore this line in accordance with the field notes of those early surveys must be based on existing evidences of those surveys in the sections further to the north. The corners of six of these sections were sought for and found, and their lines and azimuths remeasured. Valuable information was thus obtained. But still there were many perplexing conditions involved. No closed polygon, of which the meander should form a part, could be selected for computation which did not involve the work of at least three of those early surveyors, as the township, section, and meander lines had each been run by a different deputy with different chainmen, at doubtless different seasons of the year. How did their compasses agree? How did their chains compare? Were some of their measurements made over the prairie on frozen ground or ice, with, perhaps, the tall grass burned away, or were they partly made in summer, through water and mire, tall grass and cat-tails?

Without going into details here, enough has been suggested to show that a considerable amount of field work and a large amount of office work was involved in a final solution of the problem, and also in putting the results in shape for convenient location on the ground of that part of the meander line in the vicinity of the lower end of the North Channel.

The field work was mostly done at times during the month of March, when advantage was taken of the ice, and in May, 1901. The office work closely followed the field work.

A complete record of all the field work done, final computa-

tions made, information consulted with discussions, conclusions, maps, etc., relating to this work will be found in Field Book No. 42.

The quarter boats were kept as convenient and central to the work as possible by being moved forward from time to time as the work advanced. These movements were made by a tug at a cost per move, for its services, of from six to thirty dollars. The first move was made on October 12, 1899, from the first location below the Arthur House to Dederichs' Cut below the Riverside Hotel. Here the third quarter boat was added to our quarters. The second move took place on December 9th, 1899, to Goodrich's Cut below Bedore Hotel. At this place we wintered. A temporary root cellar constructed in a dredge dump served as a store room for the winter supply of potatoes and other vegetables. From this camp the survey of the South Channel was practically completed, the Muscamoot Crossing made, and work on the left bank of the Middle Channel carried up nearly to the Snooks Highway before the ice in Muscamoot Bay became unsafe for travel.

Although the last move in the fall was deferred as long as possible and then made to such a place as would be most central to the winter's work, still it was necessary to go three and four miles to a considerable part of it before navigation opened in the spring, permitting the quarter boats to be again moved. These long distances had to be traveled on foot and all material and tools hauled on hand-sleds. Weighted down with the clothing necessarily worn for protection against the cold, and the winds ready to pierce one through at every cessation of vigorous exercise, and with an eight to ten pounds pair of rubber boots on one's feet, the long journeys were fatiguing. Traveling on the ice is not easy, under the most favorable circumstances, and when slush or yielding snow overlies it traveling becomes very laborious. Each party was provided with a good sized hand sled. This with its heavy load of iron pipe, axes, maul, chisel-bar, transit-rods, and other tools for use during the day had to be hauled by the four or five assistant members of a transit party over the ice or through the slush or snow to the scene of the day's work.

At the approach of the second winter, before the ice formed, pipe were distributed to all parts where work would be carried on, or as near thereto as circumstances would permit, and stacked on end in piles. This could not be done the first winter for lack of pipe and other reasons. The sleds were still necessary for carrying the tools, etc., to and from work, or pipe and tools while at work.

Having completed, on the 17th of February, 1900, the laying out of the lots on the South Channel to within a short distance of the Private Claims, whose exact limits were not yet determined, the Muscamoot crossing was undertaken on the ice. Its great distance from the quarter boats, from which everything had to be hauled on sleds, the unexpected and annoying movement of the whole field of ice a foot or two each day disturbing our working points, the presence of a number of large air holes in the vicinity, one of which lay in the track of our work and made necessary the bringing of a skiff from the quarters with which to cross it, the dangerous thinness of the ice in places, and sudden rise in temperature and rain that set in on the last afternoon threatening to drive us from the rapidly weakening ice before the last pipe could be driven, made this work one of much labor and some anxiety.

This crossing, two miles in length, was planned on Saturday, February 17th, 1900, and on Wednesday evening, February 21st, the last pipe was driven, three days having been spent in laying out the lots. Here, as elsewhere, holes were made in the ice (through which to drive pipe corners) with axes aided by a tool called a chisel-bar which consisted of an iron rod about six feet long and an inch in diameter flattened at either end to a chisel cutting edge about two inches in width. This tool was of great service especially where the ice was thick.

Work on the Middle Channel was begun February 23d, 1900. On May 16th, 1900, the quarter boats were moved from the South Channel to the mouth of the Fisher on the Middle Channel. This was the only place on this channel where the quarter boats could lie in safety. Fortunately this location was about midway of the length of the Channel with a large part of the work concentrated in that immediate vicinity.

From this camp the survey of the Middle Channel was completed, Goose Bay Crossing made, and preliminary work on the Snibora Channel begun.

The use of a launch being at our command, when needed, from August to the close of the navigation season assisted in distributing iron, towing scows and taking parties to work, yet not without much annoyance owing to its refusal, many times, to go.

The field work of the Middle Channel was practically completed September 15th, 1900. Meanwhile the Goose Bay Crossing had been made by taking advantage of the exceptionally calm days of August 14th, 15th, 16th, 17th, 18th, 22d, 23rd, 24th and 25th. This crossing of nearly two and one-half miles in length was made entirely by working from the transit and measuring scows and was in every particular a very satisfactory piece of work. Each night the scows were necessarily towed to a place of shelter to be returned to the point of leaving off on renewing operations. On the 19th and 20th of the same month severe wind storms passed over the Flats so great as to cause one of the quarter boats to partially break away from her moorings. No harm was done, but these storms illustrate the uncertainty of the weather, even in the calmest seasons, and show the wisdom of always removing the working outfit to a place of security when not in use.

On the 18th of September, 1900, the quarter boats were moved from the Fisher to the Wellington dredge cut, on the right bank of the Snibora Channel, about midway of its length. Work of laying out lots on this channel was begun on the following day at the lower end of the left bank, and carried up along this bank to the North Channel and thence down stream on the right bank. This order of procedure was carried out on all the channels, even at some inconvenience, to secure consecutive numbering of the lots. No two lots on the same channel or section, therefore, have the same number.

After the laying out of lots on the left bank of the Snibora had been carried up nearly to the North Channel, the laying out of lots on both these channels was carried on at the same time, the aim being to complete as far as possible work lying

across main channels from the winter quarters before the freezing over of those channels, leaving the lot work that could be reached by land, or by crossing minor channels only, till later in the season, thus avoiding possible delay in the work or danger to the men during the time of the closing in of the main channels with ice—the wisdom of which was clearly shown later.

The laying out of the lots on the left bank of the Snibora Channel was completed on the 26th of October, 1900, the traverse line was completely located by the 31st and the reading of traverse line angles finished by November 3d. On November 5th, 1900, the quarter boats were moved from the Wellington dredge cut to near the head of the Snibora and tied up for the winter in the dredge cut at the lower side of Chas. Schmitt's Cottage on the right bank. Here, as in the previous winter, a temporary root cellar was constructed. This location, while distant from the work at the lower end on the right bank of the Snibora, was central to the remainder of the Snibora and all of the North Channel work. From this camp the entire work remaining was practically completed.

Between October 13th and December 21st, 1900, nearly all the lots on the south bank of the North Channel from the Middle to the Snibora Channel were laid out, as well as other work on that Channel done, while the work on the right bank of the Snibora was continued down stream, and by the close of the year the amount finished was equivalent to all that lying to the north of the Baltimore Channel or Highway. The equivalent state of progress in the making of detail sheets in pencil at the close of the year might also be fairly stated (not including North Channel sheets) as to this same highway.

The locality was fully exposed to the northwest winds across Anchor Bay and there were many days during the fall and winter months on which it was impossible to carry on field work on account of the fierce gales.

In the fall of 1899 the cuts, bays and main channel shores were largely covered with ice during the closing weeks of December, and on January 1st, 1900, the main channels themselves were completely blocked with ice, but a similar condi-

tion was not reached a year later until toward the close of January, 1901—about a month later in the season, and then with much less certainty and promptness—the ice remaining for a considerable time not strong enough to bear up the weight of a person. But as the work had been so planned that only the Baltimore Channel or Highway needed to be crossed in going to the field work from the quarter boats, the condition was easily met by placing a number of the flat bottom skiffs, which were supplied with runners, at desirable crossing places of this channel and using them as ferry boats shoving them along over the ice when it would hold and letting them launch themselves into the water when it would not. This method was used until the channels became safely frozen over.

The work of laying out lots on Strawberry Island was completed March 7th, 1901, thus finishing the Snibora Channel. This island was over three and one-half miles from camp, the traveling was often bad, the days were short and the work of setting pipe corners rendered difficult and tedious in many places because of the sands being frozen solid to a depth of eighteen or more inches wherever overlaid with a foot or less of ice. It being of course impossible to drive pipe through frozen material, holes had to be cut through the ice and frozen sands to these depths with axes and chisel-bars. This usage wore out the axes very rapidly besides being very difficult to do to such depths.

Meanwhile the lots of that part of Anchor Bay Crossing below the Baltimore Highway were laid out on February 11th, 12th and 13th, 1901, requiring two and one-half days. The part of this crossing above Baltimore Highway required two and one-half days more and these lot corners were set on the 6th, 7th and 8th of March following. This crossing was made entirely on the ice without difficulty, except that about a foot of soft snow underlaid with water above the ice made traveling difficult some of the time.

Effort was then made to complete the laying out of the lots on the left bank of the North Channel below the Snibora before the ice, now rapidly being "honeycombed" by the sun,

should loosen from the banks and "go out." This work was finished March 26th, 1901, and on the same day the ice began to run in the North and Snibora Channels. During the last few days of this work the ice became very unsafe. Fortunately, by care on the part of the men, no accident happened. A few days of "open water" followed, advantage of which was taken to continue the work on the north side of the North Channel, but presently a large quantity of lake ice began to come down and from that time until the 8th of May the channels were filled with lake ice, now grinding past like a resistless avalanche and now jammed and stationary with only here and there an opening of "blue water." It was practically impossible to cross the channels in this condition to do field work. Occasionally a crossing was made on the ice with a duck boat after the manner best known to residents of the Flats but which is not without danger at such times. The duration of this ice blockade was without a precedent within the memory of the oldest inhabitants. However but little time was lost on account of this forced cessation of field work. Most of the party was kept busy with office work,—making computations, copying and checking books, etc., and the few who could not do these things were engaged in other duties; putting the outfit in working order, and similar work.

At times during this period the water fell two feet or more below the normal stage for the season of year with the effect of laying bare vast areas of land ordinarily submerged, so that even the large bays could almost be crossed on foot. The change in the location of the water shore line was everywhere astonishing.

At the close of the ice blockade the field work was at once resumed; the topography completed on the Snibora, the section line work in connection with the location of the Fletcher Meander Line on the north side of the North Channel continued, etc. After the 15th of May, 1901, the field force was reduced to one transit party besides myself and two assistants. The work of laying out lots on the north side of the North Channel was begun by this party on May 25th and completed July 20th, 1901, thus finishing the laying out of lots on

the North Channel. Attention was then given to taking the necessary topography remaining; completing the surveys of the various Private Claims as noted elsewhere; connecting the South and Middle Channel work with these Private Claim lines; and doing the preliminary work preparatory to subdividing into lots the unsurveyed area lying between Harsen and Russell Islands opposite the lower part of Algonac, and the unsurveyed area to the westward of Private Claim Lot No. 3 on Harsen's Island. On neither of these areas, however, was the laying out of lots on the ground carried out, instructions having been received to close the field work, which was done on the evening of October 5th, 1901.

Meanwhile the quarter boats including the working outfit had been moved, September 2d, 1901, from the Snibora to the upper slip of the ship yards at Algonac. During the summer both the field and office force were gradually reduced in number. On the 28th of September the use of the Alice May and boarding on the quarter boats were discontinued. Board was furnished at a private house in Algonac for the remaining members of the party until the 18th of October, when the party was reduced to three members. Their salaries were then increased to cover subsistence dating from the 15th of October, 1901.

From the close of the field work on October 5th, 1901, to the 16th of June, 1902, the office work was continued at Algonac, in the two quarter boats remaining after turning over the Alice May. I was assisted by a draughtsman and a computer besides the services of a copyist employed from the 5th of November, 1901, to the 12th of June, 1902. After the 16th of June the office work was continued in the State house at Lansing by myself, a draughtsman, and a computer until August 23d, since which time I have continued the work alone to its completion.

The work of the survey naturally divided itself into seven sections to which the records are made to correspond. These sections taken in their order from southeast to northwest are: South Channel Section, Muscamoot Section, Middle Channel Section, Goose Bay Section, Snibora Section, Anchor Bay Sec-

LOCATING A PIPE

tion and North Channel Section. This order also indicates the general sequence in which the work was done. In each of these sections the lot numbering begins with one and continues to the highest lot number. The resurvey of the six Private Claims on Harsen and Stromness Islands comprise an eighth section or division of the work. The park areas are inclosed by these various sections. The following brief summary from which some idea of the field work can be gained is added.

	No. of lots.	No. of highways.	No. of pipe set.	No. of claimants.
South Channel section	601	63	1,710	282
Muscamoot section	44	22	131	.....
Middle Channel section	500	71	1,602	140
Goose Bay section	53	27	160	.....
Snibora Channel section	545	68	1,709	173
Anchor Bay section	48	24	141	.....
North Channel section	344	40	994	65
Totals	2,135	315	6,447	660

In the resurvey of the Private Claims and other work outside of the above sections 101 pipe were set, of which 35 had mounds built about them.

A summation of the distances measured on the work is given below.

The "front line" of each channel as used in this summation includes the front line of lots and highways fronting directly on the channel itself but not the front lines of lots and highways fronting on side channels or bays. As seen, these are included in the third item.

Sections and Items.	Miles.	Miles.	Miles.	Miles.
South Channel lots and highways:				
Front line of lots and highways	6.91			
Traverse line of lots and highways	.....	7.60		
Remaining front line, and back and side lines, etc.	.....	.....	64.91	
Total	.....	.....	.....	79.42
Muscamoot section lots and highways:				
Front line of lots and highways	2.03			
Traverse line of lots and highways	.....	1.27		
Remaining front line, and back and side lines, etc.	.....	.....	8.17	
Total	.....	.....	.....	11.47
Middle Channel lots and highways:				
Front line of lots and highways	12.45			
Traverse line of lots and highways	.....	12.89		
Remaining front line, and back and side lines, etc.	.....	.....	88.98	
Total	.....	.....	.....	114.32
Goose Bay section lots and highways:				
Front line of lots and highways	2.47			
Back and side lines	.....	.....	10.15	
Total	.....	.....	.....	12.62
Snibora Channel lots and highways:				
Front line of lots and highways	8.99			
Traverse line of lots and highways	.....	8.14		
Remaining front line, and back and side lines, etc.	.....	.....	88.04	
Total	.....	.....	.....	105.17
Anchor Bay section lots and highways:				
Front line of lots and highways	2.38			
Back and side lines	.....	.....	8.80	
Total	.....	.....	.....	11.18
North Channel lots and highways:				
Front line of lots and highways	4.69			
Traverse line of lots and highways	.....	4.34		
Remaining front line, and back and side lines, etc.	.....	.....	56.20	
Total	.....	.....	.....	65.20
Totals	39.92	34.21	325.25	399.38

Sections and Items.	Miles.
Land between Russell Island and the meander of private claim lot No. 2, Harsen Island	1.58
Distances measured between triangulation stations, traverse stations and various other prominent points, also including lines measured on Fair Haven section line work and stadia lines on Russell and Harsen Islands and in Algonac	113.62
Private claim lot No. 1, Stromness Island	5.74
Private claims lots Nos. 2, 1, 3, 4 and 5, Harsen Island	19.51
Total	140.45
Grand total	539.83

A summation of the areas of lots and highways and of park as determined by the planimeter from the General Map is given below:

Lots and Highways.	Land, acres.	Water, acres.	Total.
South Channel lots and highways	427.85	300.53	728.38
Muscamoot Bay section lots and highways	.....	116.54	116.54
Middle Channel lots and highways	783.63	515.69	1,299.32
Goose Bay section lots and highways	.....	151.48	151.48
Snibora Channel lots and highways, less—			
Strawberry and Baltimore highways	625.48	584.52	1,210.00
Strawberry highway	.....	81.97	81.97
Baltimore highway	.....	107.28	107.28
Anchor Bay section lots and highways	.....	134.76	134.76
North Channel lots and highways, less—			
Fairhaven highway	278.86	433.18	712.04
Fairhaven highway	.....	81.88	81.88
Total	2,115.82	2,507.83	4,623.65

Park.	Land, acres.	Water, acres.	Total.
Park area bounded by private claims, lines and back line of South Channel, Muscamoot section and Middle Channel lots and highways	3,348.13	3,372.08	6,720.21
Park area bounded by back line of Middle Channel, North Channel, Snibora Channel and Goose Bay section lots and highways, and side and back lines of private claim lot No. 1, Stromness Island	2,078.31	3,407.69	5,486.00
Park area bounded by back line of North and Snibora Channels, Baltimore highway and Anchor Bay section (above the Baltimore highway) lots and highways	78.56	517.64	596.20
Park area bounded by back line of Snibora Channel, Baltimore and Strawberry highways, and Anchor Bay section (below the Baltimore highway) lots and highways	100.97	686.02	786.99
Park area on north side of North Channel	.....	2.57	2.57
Total	5,605.97	7,986.00	13,591.97

The following gives a general summation of all areas covered by the survey as determined by the planimeter from the General Map.

Description.	Land, acres.	Water, acres.	Total.
Russell Island	132.82	.....	132.82
Unsurveyed land between Russell Island and meander of private claim lot No. 2, Harsen Island	29.37	.....	29.37
Private claim lot No. 2, Harsen Island	613.65	.....	613.65
Road between private claim lot No. 2 and P. C. lot No. 1, Harsen Island	19.56	.....	19.56
Private claim lot No. 1, Harsen Island	634.83	.....	634.83
Private claim lot No. 3, Harsen Island	647.32	.....	647.32
Road between private claim lot No. 3 and P. C. lot No. 4, Harsen Island	18.48	.....	18.48
Private claim lot No. 4, Harsen Island	645.43	.....	645.43
Private claim lot No. 5, Harsen I. to S. E. side of slough	621.35	.....	621.35
Private claim lot No. 5, Harsen I. from S. E. side of slough to channel, northwesterly	120.93	.....	120.93
South Channel lots and highways	427.85	300.53	728.38
Park area bounded by private claims, lots 1 to 5 and back lines of South Channel, Muscamoot section and Middle Channel, lots and highways	3,348.13	3,372.08	6,720.21

Description.	Land, acres.	Water, acres.	Total.
Muscamoot section lots and highways	.....	116.54	116.54
Middle Channel lots and highways	783.63	515.69	1,299.32
Private claim lot No. 1, Stromness Island	464.34	50.45	514.79
Park area bounded by back line of Middle Channel, North Channel, Snibora Channel and Goose Bay section lots and highways, and side and back lines of private claim lot No. 1, Stromness Island	2,078.31	3,407.69	5,486.00
Goose Bay section lots and highways	.....	151.48	151.48
Snibora Channel lots and highways (less Strawberry and Baltimore highways)	625.48	584.52	1,210.00
Anchor Bay section lots and highways	.....	134.76	134.76
Park area bounded by back line of North and Snibora Channels, Baltimore highway and Anchor Bay section (above the Baltimore highway) lots and highways	78.56	517.64	596.20
Park area bounded by back line of Snibora Channel, Baltimore and Strawberry highways and Anchor Bay section (below the Baltimore highway) lots and highways	100.97	686.02	786.99
North Channel lots and highways (less Fairhaven highway)	278.86	433.18	712.04
North Channel park area on north side of said channel	.....	2.57	2.57
Middle Channel	.....	824.74	824.74
Snibora Channel	.....	554.78	554.78
North Channel	.....	1,585.10	1,585.10
Baltimore highway	.....	107.28	107.28
Strawberry highway	.....	81.97	81.97
Fairhaven highway	.....	81.88	81.88
Total area of survey including P. C	11,669.87	13,508.92	25,178.79
Area of private claims, lots 1 to 5, Harsen Island and private claim lot 1, Stromness Island, Russell Island and unsurveyed land between Russell Island and meander of P. C. lot No. 2, Harsen Island	3,948.08	50.45	3,998.53
Total area surveyed less private claims	7,721.79	13,458.47	21,180.26

It is gratifying to report that no serious accident occurred to life or property during the two years of field operation, though carried on often times not without danger, particularly on the ice. Following the custom of the inhabitants, "muskrat spears," supplied to all the parties, were used by them to test the ice, as one advanced upon it, by thrusting the point of the spear into the ice in front. These spears resemble a large awl and consist of a wooden handle from one and one-half to two inches in diameter and two to three feet long from one end of which projects a pointed iron rod from one-fourth to three-eighths inch in diameter and two to three feet long. Each of the parties was also provided with a suitable length of five-sixteenths inch cotton line carried by one of the party in the form of a skein over one shoulder and under the opposite arm for use in case one of the party got in. Some times a long rope was attached to a sled and the men pulling it distributed along its length for greater safety. In general men were not permitted to go any great distance alone on the ice. Every reasonable precaution was taken, and yet the men now and then got in and a number of very narrow escapes from serious consequences are recalled, but, fortunately, nothing more than a cold bath or thorough wetting resulted in any case.

As to the comparative facilities afforded in winter and summer for carrying on the survey but little can be said. Each season had its advantages and disadvantages. In the summer there were waves to contend with often times, but getting from place to place in skiffs or with the launch was easier than on the ice, particularly when covered with snow or slush. The summer furnished better facilities for properly planning out the work on the ground when all conditions of shore and depth of water could everywhere be readily seen.

In the work of laying out lots there was more cutting of lines in summer than in winter. On the other hand setting pipe in water, shallow enough to be easily waded with rubber boots, could probably be done with more facility than where holes had to be cut through thick ice. In deeper water work-

ing with the scows was slower than on the ice under favorable conditions for both. The winter days furnished fewer hours per day for work than in summer, as it was absolutely unsafe to be out after dark in winter. Winter work, too, might be more distant from camp than in summer and a larger proportion of the time consumed in going and coming. Those periods of change from open water to ice bound channels, or the reverse, in the late fall and early spring offered the greatest hinderance to progress.

In conclusion I may say that the whole work has been carried on under great natural difficulties,—water and air, ice and snow, winds and waves have been to contend with. Only by taking advantage of every favorable condition, by keeping every feature of the work planned well in advance, by keeping the force constantly employed—changing from one thing to another or from field to office work as weather conditions dictated, and by constant vigilance and push has it been possible to bring the many elements of the work to a successful completion in the time actually consumed.

The detail sheets, as the maps of the survey are called, are on sheets of Whatman drawing paper Super Royal (19 by 27 inches) in size but mainly of Double Elephant thickness, mostly with hot pressed surface and having a protractor circle 14 inches in diameter, graduated to one-quarter degrees stamped centrally upon each sheet. By means of this circle the azimuths of the various lines as they were read in the field were easily laid down on the sheets by the use of a steel straight edge and triangle. Distances were plotted with a flat scale graduated into eightieths of an inch on one edge and one hundredths on the other.

The finished size of these detail sheets is 17 by 26 inches and 15 by 24 inches within the border line. All of the sheets, with the exception of the three sheets showing the Private Claims on Harsen Island on which north and south has a direction of forty-five degrees with the side of the sheet, are oriented so that north and south always correspond with one of two directions—lengthwise of the sheet or at right angles

thereto. A suitable north point showing the relation of the azimuths of the lines to the cardinal points is drawn on each sheet. The relative position of the sheets is such that each lot will appear entire on at least one sheet. In many places where the grouping of the lots is complicated this necessitates a considerable overlapping of the sheets.

On each sheet is represented the data contained in the field and stadia books within the limits of the sheet, such as the direction and measurement of lines, pipe corners and their markings, buildings, sheet piling, dredge cuts, dredge dumps, ditches, raised ground limits, cultivation limits, fences, docks, shore lines, etc. The number of each lot, the names of the highways and of the channels as well as of the leading hotels, club houses, etc., also appear.

There is also printed on each sheet a "note," an "explanation" of the meaning of the various lines, a scale (though sometimes drawn) and a title in which appears the name of the section to which the sheet belongs, the total number of sheets in that section, the number of the sheet itself and other statements which serve to identify the sheet as a part of the records of the St. Clair Flats survey in accordance with the Legislative Act of 1899.

All the lots on the four channel sections namely, South Channel, Middle Channel, Snibora Channel and North Channel are plotted on these sheets to a scale of 80 ft. to one inch. Where the lots were small or the improvements extensive this scale was none too large for a practical representation of them. In other cases a smaller scale would have served every purpose but for the sake of uniformity the scale was not varied on these sections. Supplemental detail sheets to a smaller scale were, however, made of certain localities where a general idea of them could not well be gained on account of their complexity from a grouping of these large scale detail sheets, and thus the relative position of a large group of lots or related objects was exhibited on a single sheet. These smaller scales were always some simple multiple of the large scale.

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A list of these reduced scale detail sheets is given below.

Section.	Sheet No.	Scale.	Locality shown.
South Channel..	1.....	400 ft. to one inch....	"Old Club" lot 1, Ship Canal, etc.
Middle "	12.....	160 " " "	Three Rivers highway.
" "	23.....	240 " " "	Muscamoot Ridge.
" "	41.....	560 " " "	Private claim lot 1, Stromness Island.
" "	55.....	240 " " "	Fisher highway.
" "	73.....	240 " " "	Lower end, right bank.
Snibora "	21.....	160 " " "	Head of channel.
" "	37.....	400 " " "	Baltimore highway.
" "	68.....	400 " " "	Strawberry highway.
North "	35.....	400 " " "	North side of channel.

All the lots of the Bay (crossing) sections, namely, Muscamoot Section, Goose Bay Section and Anchor Bay Section are plotted on the sheets to a scale of 160 ft. to the inch.

The three sheets showing the five Private Claims at the head of Harsen Island have a scale of 560 ft. to the inch.

The field and stadia notes, that is, the lot lines and topography, were first plotted in pencil on the detail sheets—the former by means of the protractor on the sheet itself, as indicated above, and the latter by means of a movable protractor made by cutting out the center portion of a sheet, orienting it at each stadia station and plotting the stadia "shots" with a scale using the data as read in the field as polar coordinates.

This plotting in pencil was kept as close up to the field work as circumstances would permit, and served as a check on large errors in the field. Computation was, however, relied on to check the field work, particularly the measurements, as the azimuths were required to be checked in the field. The computations made will be found in the Computation Books.

These pencil sheets were subsequently finished in ink. The inking up of the sheets required, on the part of the draughtsman, the ability to make plain neat letters and figures of various sizes inclined or upright and of uniform or shaded lines. Of the many who claimed to be draughtsmen and tried to do the work only three were competent and satisfactory.

One of these remained on the work three months and one, an engraver, six months, while the third, who came to us in the early part of the work as an office man and who was employed to plot the sheets in pencil, so developed his draughting abilities as to enable him to do the inking quite as satisfactorily as it had been done by the other two, and from May, 1901, to the close of the work he was employed in inking the sheets, tracings, General Map, etc. I refer to Mr. John Schmutz.

After the detail sheets were finished in ink, tracings were made of them on tracing cloth and the same "note," "explanation," scale and title printed thereon as on the corresponding sheets.

The sheets when completed were carefully compared with the Field Books and with the Computation Books and also with each other where they overlapped. The tracings were likewise carefully compared with the sheets and, where they overlapped, each tracing was compared with the sheet of the other. The sheets and tracings were also carefully examined with reference to details of topography and execution. Comparisons were also made between detail sheets and tracings of reduced scale and the sheets of large scale covering the same locality.

The effort has been made to make the sheets and tracings accurate in every particular, and it is believed the remaining errors, if any, are few in number and unimportant in character.

After the tracings of a section were completed and checked, six blue print copies were made of each tracing before forwarding the sheets and tracings with the other records of that section to the Land Office. One complete set of blue prints was made for the purpose of being deposited in the register of deed's office of St. Clair county as required by the act, one was retained for use on the work to which frequent reference was made, one went to the United States Engineer Office at Detroit, etc. Between 1,500 and 1,600 blue prints were required. The continuous cloudy weather at the Flats, particularly during the winter season, frequently prolonged the time required to complete these prints.

It has been thought advisable to accompany each of the patents issued by the State to claimants of lots, as provided for in the act, by a blue print copy of the tracing of the sheet on which the claimant's lot appears. Blue prints so used trimmed to 16 by 26 inches in size, which the width of the border permits, and folded twice will conform to the size of the ordinary legal document.

The desirability of having the office work closely follow the field work was recognized at the outset, but owing to the inability to obtain suitable draughtsmen, and the repeated failures of those engaged to do the work, there was always a considerable interval of time between finishing the field work of a section and the completion in ink of the maps and tracings of that section. The plotting of the field work in pencil on the detail sheets was, however, kept quite close up with the field work after the office work began, but it was not until the 15th of December, 1899, that an office man was secured for this purpose, and not until May 1st, 1900, did a draughtsman capable of inking up the sheets and tracings report at the quarterboats. On the 26th of July, 1900, this draughtsman completed the forty-two sheets and tracings covering the field work of the South Channel so far as finished on the 17th of February as elsewhere noted. On the 31st of the same month he finished the sheets and tracings of the Muscamoot Section and closed his work on the survey—his engagement having been temporary. On July 27th, 1900, forty-two detail sheets and all of the records relating to the South Channel were sent to the Land Office excepting forty-two tracings and the filing envelopes which were forwarded on August 4th. The few remaining maps, tracings and records relating to the closure of the South Channel lots on the Private Claims were turned over to the Land Office at the close of the work.

The second draughtsman reported on July 22d, 1900, and closed his services on February 2d, 1901, having meanwhile completed the inking up of the sheets and tracings of the Middle Channel and of Goose Bay Section except parts of certain sheets which could not be completed until after connec-

tion had been made, in the field, with Private Claims and the Snibora Channel work.

Blue prints of the seventy-one completed tracings of the Middle Channel having been finished on February 21st, all the sheets, tracing and other records of this channel, completed as above noted, except the Stadia Books, which were retained for use in plotting the general map, were turned in to the Land Office on February 28th, 1901.

The sheets, tracings and other records of the remaining sections were not sent to the Land Office as completed from time to time, but were retained till the close of the work. Neither was the work on any particular section kept strictly continuous until its completion, but was varied from one section to another as necessity or the best progress of the work as a whole dictated or demanded.

The inking up of the sheets of the Snibora Channel was begun May 6th and practically completed June 22d, 1901, and their tracings were finished January 24th, 1902. Meanwhile the remaining uncompleted sheets and tracings of the South and Middle Channels were finished after connection had been made in the field with the Private Claim lines and other mapping done.

The Anchor Bay sheets and tracings were finished on February 17th, 1902. The sheets of the North Channel section were completed March 6th and their tracings by April 2d, 1902. The inking in of the lot numbers and of the names of the highways on the sheets of the North Channel and Anchor Bay sections was greatly facilitated by the use of a small printing device in connection with carbon paper by which the names and large figures were impressed on the maps and then finished in India ink.

To accompany the detail sheets and tracings of the various sections a General Map has been prepared to a scale of 800 ft. to one inch covering the entire area surveyed. In size it is 75 inches east and west and 59 inches north and south. It shows the topography of the Flats and the lots, highways, park areas and Private Claims surveyed. It has been plotted

with extreme care by the rectangular coordinate method. The origin of coordinates is station Fisher. Through it coordinate axes were drawn on the map and lines parallel to them at intervals of 5,000 ft. Points of the general triangulation were then plotted from their mean coordinates as found in Triangulation Book No. 1. These points served as origins for plotting the angles of the large adjusted polygons and these angles in turn formed origins for minor polygons, and so on down to the lesser details, using the coordinates of the various polygons as found in the Coordinate Books.

A General Azimuth Map has also been prepared by taking from the General Map a tracing of the topography of the Flats, and of the traverse and general triangulation angles and adding thereto the many general lines whose azimuths were read. It exhibits the many lines by which the whole work is tied together. From it an azimuth can readily be obtained in any part of the Flats in case it is desired to retrace any of the lot lines in future years.

Thirteen tracings were also taken from the General Map, every detail, topography, lot lines, etc., being traced. Each of these tracings is of the same size size as the detail sheets and tracings and taken together form one complete tracing of the General Map.

On these tracings were then drawn in their correct relative position rectangles representing the detail sheets, within their border line, to the scale of these tracings. In one corner of each rectangle so drawn was plainly written the number of the sheet it represents. A north point and an appropriate title were also placed upon each of the tracings. The number of each lot was also written within its boundary lines.

These tracings constitute the Index Sheets to the sets of sheets and tracings of the various sections. Thus, two of them make up the Index Sheets of the South Channel detail sheets and their blue prints are placed with the South Channel tracings as an index to them for use in the office. Three others form the Index Sheets for the Middle Channel Sheets, etc.

Various minor tracings were also prepared, blue prints of which are to be found in a number of the record books.

A list of all maps and tracings will be found in the general list of records of the survey.

All Field Books have been put in suitable form for permanent record at the Land Office, with descriptive title within and a distinguishing designation without, both on the back of the book and on the cover. Each book has also been gone over by myself line by line, and item by item for the purpose of removing any possible errors in the text or sketches. These Field Books are forty-three in number. Nine relate to the South Channel, ten to the Middle Channel, including the Muscamoot and Goose Bay sections, thirteen to the Snibora Channel, including Anchor Bay section, and eight to the North Channel. Books Nos. 41 and 43 relate exclusively to the resurvey of the Private Claims on Harsen and Stromness Islands, and No. 42 deals solely with the restoration of the Fletcher Meander line on the north side of the North Channel. Nos. 1, 4, 12, 15, 22, 25 and 36 are general in character, as they relate to planning and laying out the work. The remaining books contain the records of the operations of the transitmen in laying out the lots.

The Stadia Books are twenty-two in number, and contain the record of the topographical survey. Like the field books, each has a title descriptive of locality within, and a distinguishing designation without on back and cover, and is also indexed when the work of which it is the record is without the area of the lots. The first five of these books relate to the South Channel, the eight following to the Middle Channel, etc.

The Computation Books are twelve in number. In them are recorded, in ink, the office computations, made primarily for the purpose of checking the accuracy of the field work, but which also furnish data for computing the coordinates for plotting the General Map. These computations consist of latitude and departure computations of polygons of all sizes, from those of a single lot to those of miles in circumference. The errors of closure in the latitudes and departures of these polygons furnish a criterion for judging of the accuracy of the field work. At first polygons embracing several lots were selected for computation, but it was soon found advisable to

compute every lot or highway laid out that was not a parallelogram or rectangle in shape, and this was done. A sketch of each polygon on which the azimuths and lengths of its sides are written accompanies each computation. These books are all completely indexed and have titles within, and distinguishing designations without, like other record books. Their distribution among the different channels or sections will be shown in the list of records given below.

The Claim Books, as heretofore stated, contain the statements of claimants to lands on the Flats. The situation and extent of the various highways are also described for convenience of reference. Each book is supplemented by an alphabetical index of highways, a numerical index of lots claimed, and an alphabetical index of claimants to lots. The four Claim Books are designated as the South, Middle, Snibora and North Channel Claim Book, respectively. The size of page is 12 by 7 inches, while all other records are in engineering field books with 8 by 5¼ inch pages.

In the Frontage Books, as their name implies, such frontages are assigned to the lots as are considered equitable in the matter of settlement with claimants, or in the sale of unclaimed lots on the basis of frontage. In general, these frontages agree with the frontages of the lots as found on the maps, and only materially differ from them where the length of frontage of a lot is disproportional to its area. In the case of irregular lots, other information obtained from the maps is also stated in regard to them, such as rear width, mean depth, a second frontage, length of side line on a highway, etc. The channel, highway, or bay, on which the lot frontage is taken, is stated, and where lots are claimed the name of the claimant is given. An alphabetical index of claimants is also added. Title and exterior designation, as on other record books, complete these books, which are four in number, namely, the South Channel, the Middle Channel, which includes the frontages of Muscamoot and Goose Bay sections, the Snibora Channel, including the Anchor Bay section, and the North Channel Frontage Book.

In the Filing Envelopes, returned as a part of the records,

will be found the letters or other papers received from claimants during the survey relating to their claims. The name of the channel, the number of the lot, the name of the claimant, and the contents of the envelope appear on the outside of each for ready reference.

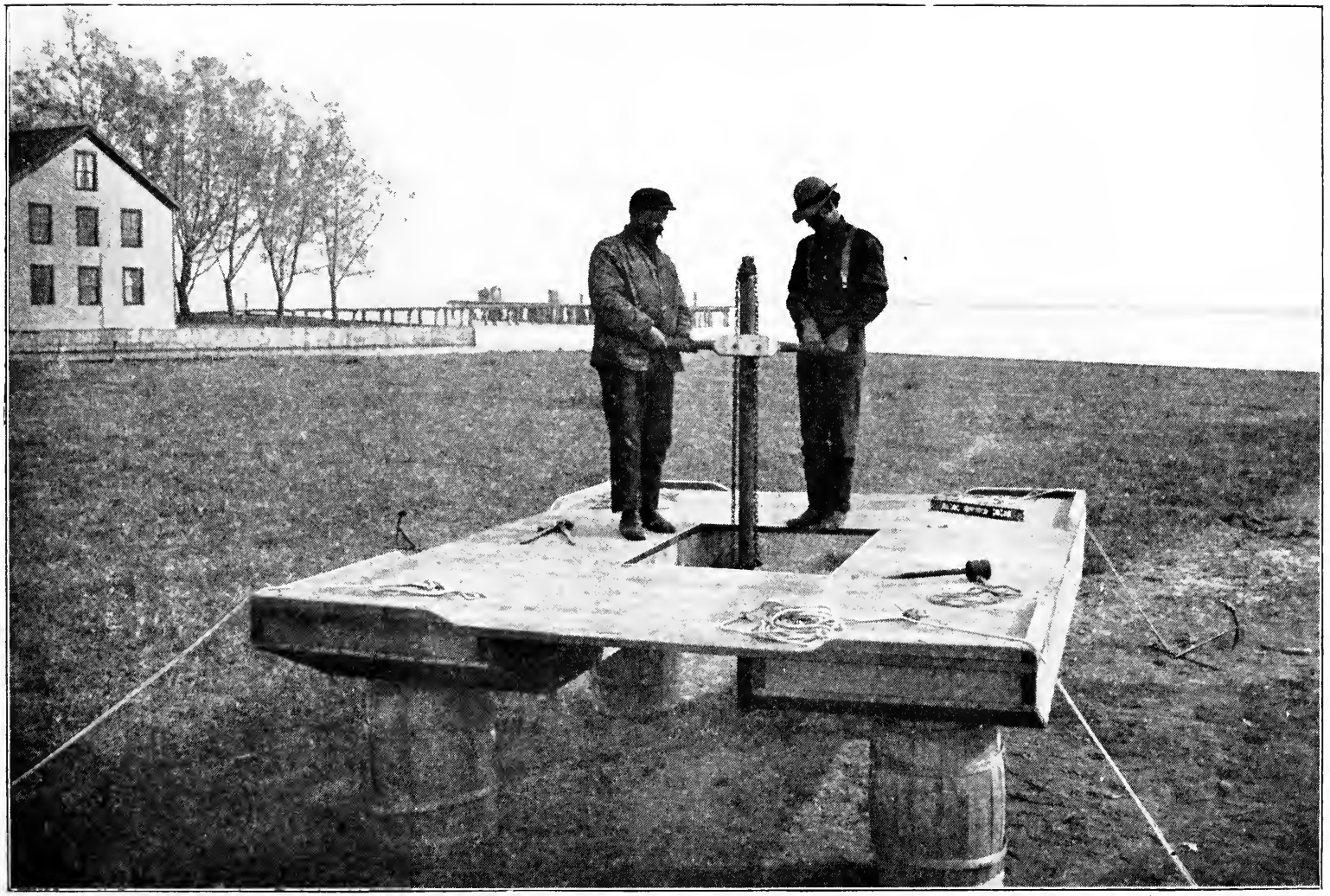
In the Area Book are recorded the planimeter determination of the areas embraced within the limits of the survey as obtained from the General Map. These areas, in which the land and water areas are kept separate, have been obtained in considerable detail, the results have been grouped or classified by islands and by channels, and a general summation also made, so as to readily supply almost any information likely to be desired in respect to them. The areas of the various claims in the interior of Harsen Island, southwest of the Private Claims, now occupied for farming or grazing purposes, are also given. The book also contains a summation of distances measured, classified and grouped in various ways.

Finally, to make the information contained in the various records easily accessible, index cards have been prepared for each section of the work. This indexing is by lots. A separate card is made out for each lot. On this card appear the number of the sheet on which the lot is drawn, the name of its claimant, if any, and the book and page references where may be found its claim record, its frontage, its computation, the notes of the field operations performed, either in laying it out or within its bounds, and any correspondence regarding it.

Similar cards have also been made out for the Private Claims on Harsen and Stromness Islands, as well as for the interior claims on Harsen Island, southwest of the Private Claims and for an island in Goose Bay.

It will be perceived that a considerable amount of labor was involved in the preparation of these 2,152 index cards, necessitating, as it did, a careful perusal of the Field and Stadia Books and a careful, though more general examination, of all the other records.

In order that a more comprehensive view may be had of the field records and office work, there is given the following index list of records returned to the Land Office:



MEASURING SCOW—DRIVING PIPE.

Kind of Record.	South Channel section.	Muscamoot (crossing) section.
Field books	Nos. 1, 2, 3, 4, 5, (6-8) 7, 9, and (10-11).	See Middle Channel field books Nos. 10, 11. 12 and 13.
Stadia books	Nos. 1, 2, 3, 4 and 5.	See Middle Channel stadia book No. 8.
Computation books	Nos. 1 and 2.	See Middle Channel computation book No. 3.
Claim book	South Channel claim book.	
Frontage book	South Channel frontage book.	See Middle Channel frontage book.
Original detail sheets	44 (1 to 42 inclusive and 43a and 43b).	3.
Tracings of detail sheets	44 (1 to 42 inclusive and 43a and 43b, also tracing of sheets 2-3 combined).	3.
Index sheets (tracings)	2.	1.
Index sheets (blue prints)	2.	1.
Index cards (by lots)	(611) 601 of South Channel lots and 10 of interior claims on Harsen I. S. W. of P. C.	44.
Filing envelopes	131.	

Kind of record.	Middle Channel section.	Goose Bay (crossing) section.
Field books	Nos. 10, 11, 12, 13, 14, 15, 16, 17, 18 and 20.	See Middle Channel field books Nos. 15, 17 and 18.
Stadia books	Nos. 6, 7, 8, 9, 10, 11, 12 and 13.	
Computation books	Nos. 3, 4 and 5.	See Middle Channel computation book No. 5.
Claim books	Middle Channel claim book.	
Frontage book	Middle Channel frontage book.	See Middle Channel frontage book.
Original detail sheets	77.	4.
Tracings of detail sheets	77.	4.
Index sheets (tracings)	3.	1.
Index sheets (blue prints)	3.	1.
Index cards (by lots)	500.	53.
Filing envelopes	34.	

Kind of record.	Snibora Channel section.	Anchor Bay (crossing) section.
Field books	Nos. 19, 21, 22, 23, 24, 25, 26, 27, 29, 31, 32, 33 and 34.	Books Nos. 25, 31, 32, 33 and 34 of Snibora Channel.
Stadia books	Nos. 14, 15, 16 and 19.	See North Channel stadia book No. 18, and Snibora Channel stadia book No. 16.
Computation books	Nos. 6, 7, 8 and 9.	See Snibora Channel computation book No. 9.
Claim book	Snibora Channel claim book.	
Frontage book	Snibora Channel frontage book.	See Snibora Channel frontage book.
Original detail sheets	68.	4.
Tracings of detail sheets	68.	4.
Index sheets (tracings)	2.	1.
Index sheets (blue prints)	2.	1.
Index cards (by lots)	(546) 545 of Snibora lots and 1 of islands in Goose Bay.	48.
Filing envelopes	33.	

Kind of record.	North Channel section.	Private claims on Harsen and Stromness Islands.
Field books	Nos. 28, 30, 35, 36, 37, 38, 39, and 40.	Nos. 41 and 43.
Stadia books	Nos. 17, 18, 20, 21 and 22.	See North Channel stadia book Nos. 20, 21 and 22 and Middle Channel stadia books Nos. 8 and 9.
Computation books	Nos. 10, 11 and 12.	See North Channel computation book No. 12.
Claim book	North Channel claim book.	
Frontage book	North Channel frontage book.	3 (Harsen Island).
Original detail sheets	35.	3 (Harsen Island).
Tracings of detail sheets	35.	
Index sheets (tracings)	3.	
Index sheets (blue prints)	3.	
Index cards (by lots)	344.	(6) 5 of private claims on Harsen Island and 1 of private claim on Stromness Island for map of which, see Middle Channel sheet, No. 41.
Filing envelopes	10.	

Kind of record.	Fletcher Meander Line. On north side of North Channel, Ts. 2 and 3 N., R. 15 E., Mich.
Field book	No. 42.
Stadia books	See North Channel stadia books Nos. 18 and 20.
General records	Triangulation computation books Nos. 1 and 2.
	Co-ordinate computation books Nos. 1 and 2.
	General map St. Clair Flats survey.
	General azimuth map St. Clair Flats survey (tracing).
	Planimeter area determinations from general map. Area book.
Minor records	Tracings (blue prints of which, except the last, are to be found in various record books).
	Map of general triangles, St. Clair Flats survey.
	Triangulation of North and Middle Channels from Sta. Quibell to Sta. Pipes Russell Island (or adjacent to the private claims on Harsen Island).
	Triangles of North Channel near Pt. aux Chenescle.
	Plat of section lines in T. 3 N., R. 15 E. Retraced and of traverse polygon embracing sections in Ts. 2 and 3 N., R. 15 E.
	Map showing present shore line of Anchor Bay and North Channel in Ts. 2 and 3 N., R. 15 E., and location of the Fletcher Meander Line, etc.
	Copy of Plat of Ts. 2 and 3 N., R. 15 E. from land office.
	Map of claims in the interior of Harsen Island S. W. of the private claims.
	Working sheet of proposed lots (not laid out) between P. C. lot No. 2 Harsen Island and Russell Island, etc.
	Working sheet of proposed subdivision into lots and park of lands between the Meander lines of P. C. lot No. 5 Harsen Island and the Middle and North Channels.
	Copy of map of private claims on Harsen Island found in St. Clair Co. Atlas of 1876.
	Copy of Curtis R. Champion's plat of Roby point.
	Copy of Algonac, Mich., in St. Clair Co. Atlas of 1876.

In carrying out and directing the details of this survey, I have sought to attain the following ends, believing that only in their realization could the survey be of real value:

First, That the work in the field should be accurately done in every particular—in the measurement of distances, in the reading of azimuths, in the setting, marking and driving of corners, etc.—and that the field notes should be a full, clear and accurate record of all the field operations;

Second, That all the office work should be characterized by neatness, clearness and accuracy, whether exhibited in the maps and tracings, or in the books of record; and

Third, That every item of information contained in any of the records should be quickly reached through the medium of a comprehensive index.

In this connection it affords me pleasure to express my appreciation of and acknowledge my indebtedness to the services of those of my co-workers who, by faithfulness, interest and intelligent and painstaking efforts have contributed their share toward making the survey and its records trustworthy in every respect.

Information as to the force employed, periods of service and salaries paid in making the survey, may be gathered from the following summaries of expenditures compiled from the pay rolls:

To whom paid.	Amounts by approximate yearly periods.			Total amounts.
	From Sept. 5, 1899, to Sept. 15, 1900.	From Sept. 16, 1900, to Sept. 15. 1901.	From Sept. 16, 1901, to Oct. 15, 1902.	
Fred Morley	$2,170 11	$2,100 00	$2,512 19	$6,782 30
Fred C. Hannan	99 10	.....	.....	99 10
George D. McNaughton	539 57	9 33	.....	548 90
Louis E. Seas	675 03	.....	.....	675 03
Jos. A. Shannon	681 33	695 71	40 64	1,417 68
John Bonin	77 97	.....	.....	77 97
Edward L. Ferris	62 88	.....	.....	62 88
Milton W. Guy	370 80	424 42	.....	795 22
Oliver S. Kerr	235 48	.....	.....	235 48
Sylvester S. Zeluff	35 00	.....	.....	35 00
Eugene F. Slayton	128 14	.....	.....	128 14
Forest E. VanDeventer	80 00	.....	.....	80 00
Ernest D. Rankin	43 50	.....	.....	43 50
Louis A. Barkume	44 00	.....	.....	44 00
Ed. L. Wegener	491 68	433 77	.....	925 45
Robt. A. Howard	346 89	113 12	.....	460 01
Edward Bird	90 92	.....	.....	90 92
Chas. E. Curtis	234 93	.....	.....	234 93
Wm. S. Parker	353 45	.....	.....	353 45
Dennis McNeill	78 96	.....	.....	78 96
Wm. Mott	69 11	.....	.....	69 11
Jay Duncan	275 13	191 33	.....	466 46

To whom paid.	Amounts by approximate yearly periods.			Total amounts.
	From Sept. 5, 1899, to Sept. 15, 1900.	From Sept. 16, 1900, to Sept. 15, 1901.	From Sept. 16, 1901, to Oct. 15, 1902.	
Wm. R. Yax	$62 33	.....	.....	$62 33
Chas. L. Todd	38 50	.....	.....	38 50
Wm. Gilbey	90 83	.....	.....	90 83
Radcliffe T. Rattay	89 17	.....	.....	89 17
John Schmutz	530 97	$773 05	$1,099 57	2,403 59
Neil Shannon	121 59	242 06	.....	363 65
Thomas W. Spooner	14 45	.....	.....	14 45
Ray Thorp	201 72	273 67	.....	475 39
Lloyd E. McLaughlin	177 97	.....	.....	177 97
Emil C. Young	199 38	163 73	.....	363 11
Chas. J. Lyons	227 21	356 92	431 69	1,015 82
Wm. H. Gowan	54 73	.....	.....	54 73
Samuel Crocker	415 81	40 61	.....	456 42
Harry S. McDonald	202 78	166 72	.....	369 50
James Shannon	172 97	233 60	.....	406 57
Geo. Brose	14 01	.....	.....	14 01
Claud D. Morrison	136 42	20 14	.....	156 56
Leslie Wreggit	119 05	79 82	.....	198 87
Chas. S. Sheldon	234 85	.....	.....	234 85
Ernest D. Clark	81 20	342 35	38 93	462 48
Chester G. Finster	25 29	.....	.....	25 29
Wm. Brandstetter	124 44	312 58	.....	437 02
John D. Price	33 42	409 07	60 83	503 32
A. C. Carton, use of launch	54 75	243 75	27 75	326 25
Frank I. Loukes	60 97	463 42	.....	524 39
Elmer M. Ellsworth	28 00	860 71	1,119 12	2,007 83
Peter M. Louwerse	23 33	688 93	26 83	739 09
Fred W. Cram	.....	203 46	.....	203 46
H. G. Merrick	.....	359 71	.....	359 71
Carroll S. Forbes	.....	99 42	.....	99 42
John H. Thayer	.....	1 61	.....	1 61
Robt. H. Ellsworth	.....	190 99	.....	190 99
R. A. Field	.....	144 42	.....	144 42
Geo. A. Plouffe	.....	13 37	.....	13 37
Louis E. Stridiron	.....	4 35	.....	4 35
J. J. Barton, Jr.	.....	33 42	.....	33 42
Fred Schaar	.....	23 94	24 68	48 62
A. A. Hubbard	.....	.....	23 71	23 71
Total amounts	$10,720 12	$10,713 50	$5,405 94	$26,839 56

While it is not possible to make a strictly exact apportionment of the total pay roll expenditures among the different divisions of the work, since the same person sometimes performed one kind of service, and sometimes another, as occasion required, yet the following statements may be taken as very closely correct:

For services of cook, cook-helper and caretaker of the boats for the two years and one month during which subsistence was furnished on the boats.... $2,530 00

For office work of every kind—making maps and tracings, computing, check books and maps, copying claims, indexing, etc., etc..... 9,127 70

This does not include $241.75 paid Richmond & Backus Co., Detroit, Mich., for printing title, note, explanation and scale on maps and tracings.

For use of the launch for 108¾ days, during the time it was at our disposal..... 326 25

This does not include the charges paid for an occasional day's use of other launches at other times, amounting to probably not over $50.00.

For the field work of the survey..... 14,855 61

Yours truly,
FRED MORLEY,
Resident Engineer.

REPORT OF SPECIAL REPRESENTATIVE.

St. Clair Flats, November 15, 1902.

Hon. Edwin A. Wildey, Commissioner of the State Land Office, Lansing, Michigan:

Sir—I beg leave to present this, my final report, as representative of the State Land Office on the State survey of the St. Clair Flats.

I assumed the duties of this position on the 10th day of November, 1899, by orders of Hon. William A. French, then Commissioner of the State Land Office, and proceeded at once to the St. Clair Flats, arriving there at noon on November 11, 1899. The work had been in progress there for about two months and the quarter-boats, consisting of the "Alice May" and the "Michigan," lay in a cut near the "Marshland Club," on South Channel of the St. Clair river. I immediately commenced my labors, which consisted of supplying the necessary tools and materials for the men to work with and the necessary food for their subsistence, together with the supervision of the cooks and caretakers of the boats. The cooking was then done in both quarter boats, the "Alice May" and the "Michigan." On December 25, 1899, the third quarter-boat and a small tug arrived from Port Huron, in charge of Mr. Carmichael, and this completed the number we had during the entire survey. In December we moved the whole outfit to a cut near Joe Bedores' hotel, on South Channel, and commenced preparations for the winter. A sufficient supply of coal, to last during the winter, was ordered from Detroit and brought up by boat. Iron pipe was purchased, to be used in place of wooden stakes to mark the corners of lots, and was

delivered in the same way. A root house, or outside cellar, was built in the bank of a pile of dirt thrown out by the dredge in making a cut, and in this were stored potatoes, cabbages, onions and turnips, and such other vegetables as are relished by a hearty man after working all day in the bracing air of the St. Clair Flats. During the holiday vacation, while the men were all away but one, we made several important changes in our quarters. The cooking and dining on the quarter-boat "Alice May" was discontinued, and all cooking and dining was done thereafter on the "Michigan," thus leaving the dining-room of the "Alice May" for an office and the kitchen for a place where water could be warmed and a bath taken by the men in the winter. During the winter of 1899 and 1900, all provisions and supplies of all kinds had to be brought across the country with sleds when the weather and ground would permit, and with small boats when the river was free from ice. As the distance from our winter quarters to Algonac, our base of supplies, was about seven miles, and as the river had to be crossed in order to reach the post-office or railroad station, you can imagine that at times it was very inconvenient and dangerous, especially when the ice was running down the river from Lake Huron in large quantities, forming great ice jams that would crush any small boat to splinters. The mail was brought from Algonac on an average of three times a week, and, nothwithstanding the ice jams or the inclemency of the weather, the mails went out and came in, tools and material were furnished, and no one went hungry. In the spring, when the Star Line boats commenced running between Detroit and Port Huron, the question of mails and supplies was simplified, as our mails and goods were delivered at Joe Bedores' hotel, only a few rods away. In the summer of 1900 we moved to the Middle Channel of the St. Clair river, and cast anchor near the mouth of the Fisher Channel. Here the question again confronted us of how best to get our supplies and mails, as we had left the channel where the boats traveled and were again seven miles from Algonac. I found it would be necessary to have some means of locomotion other than a row boat, and I built and equipped a gasoline launch at my own expense.

MEASURING SCOW—DRIVING AND PLUMBING PIPE.

This boat was twenty-two feet long with a six and one-half foot beam, and was propelled by a three horse-power gasoline engine. Her name was "Evangeline," and well was she named, for no daughter of Acadia was ever more loyal or constant than the "Evangeline" of the St. Clair Flats survey. With this launch all the supplies were handled, measuring and transit scows moved from place to place, iron pipe distributed along the shores, and the men taken to and brought from their work, when the distance was too great for them to travel. The winter of 1900 and 1901 was spent in Scotten's cut on the Snibora Channel, we having moved there on the 5th day of November, 1900. Profiting by my experience of the first winter, I immediately set about making preparation for the winter of 1900 and 1901. I constructed an outside cellar large enough to hold all the vegetables necessary for the supply of the crew till spring, and in this was placed a goodly supply of all kinds of vegetables necessary to the physical preservation of men employed in such work. This outside cellar was built as an ordinary small house, with two by fours and sheeting boards, and covered all over with three feet of marsh hay and two feet of dirt. It had two chimneys in the roof for ventilation. In this root cellar was built bins for all the different kinds of vegetables. The cabbages were placed in one of these bins with a layer of marsh hay about six inches thick between the layers of cabbages. I found this to be a good idea, as it took up all the moisture, and if one vegetable started to decay, its neighbor felt none of the bad effects from its unkind actions. The storeroom in the third quarter-boat was well stocked with groceries, and several barrels of kerosene oil were procured for use in the lamps during the season, and, strange as it may seem at the present time, enough hard coal was procured at $7.50 per ton to supply seven stoves during the winter. In the fall of 1901 we moved to Algonac in a cut belonging to A. M. Smith & Son, and remained there till the field work was completed and the quarter-boats closed. During our work on the St. Clair Flats we were treated very kindly by all its people, and never to my knowledge was there an unkind deed or word to mar the memory of those two years. Of the good

people of Algonac I cannot speak too kindly, for their ever kind acts and words will always be among the pleasant things to be remembered by me. I could not close this report without mentioning one, who, outside of Prof. Davis and Prof. Morley, helped as much to make this survey a success as any one on the work. I mean our good cook, Mr. Joseph A. Shannon. Always prompt and on time with all meals, courteous and kind to all, he was endowed with a fresh amount of native Irish wit that spread a ray of sunshine over all. He cooked the first meal and the last meal on the survey, and all who knew him during these two years on the Flats, and knew how much his loyalty and good work assisted in making this survey a success, will say that he deserves honorable mention. In the winter of 1901 and 1902 yourself and Mr. Wheeler of Salem, Washtenaw county, made an appraisal of all the State's property used in connection with the St. Clair Flats survey, and authorized me to sell it for not less than the appraised value. I sold the outfit for fifty per cent more than the appraisal to parties in Algonac who have since sold them to Canadian parties who took them across the river and the people who inhabit them from now on will say "God save the King." Below you will find the cost to the State of the survey which fully agrees with the books of the State Board of Auditors.

Equipment	$4,396 64
Salaries	28,352 58
Subsistence	9,427 00
Maintenance	10,369 05
Total	$52,545 27

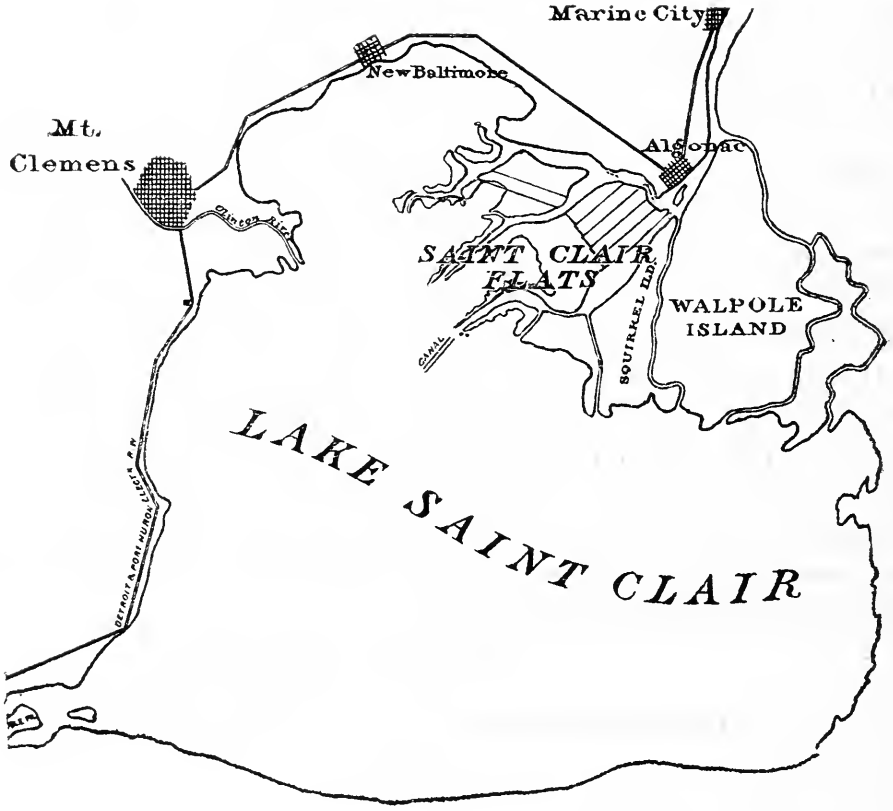
The item for equipment includes the first cost of the entire outfit. The item for maintenance includes cost for keeping everything in repair and all expenses such as freight, drayage, traveling expenses and all supplies not eatable. The item of salaries includes all moneys paid in way of salaries by Board of State Auditors or otherwise and includes more

than amount on State survey pay roll. The item for subsistence includes all moneys paid for eatables. During the whole time I was on the work I received the kindest treatment and most generous consideration from Prof. J. B. Davis, your chief engineer. His sterling qualities, his strong ideas of right and wrong, coupled with his ability and kind heart, have given him a position at the head of his profession and a place in the hearts of us who know him best. I wish to thank Prof. Fred Morley for his kindness to me during the time I was engaged on this work. While he was untiring and constant in his labors he always found time to say a pleasant and encouraging word to his men. Endowed with a sense of honor and justice he listened to the tales of all and then followed the road that duty and justice pointed out. And now, as I am about to close this report, and I look back over the winters of ice and snow with their cold winds blowing across the Flats from Lake St. Clair, or the river filled with floating ice and snow over which I traveled to keep the men supplied with food and material, and find that after all this not one gray hair has made its appearance, I have come to the conclusion that it was the generous treatment, the ever disposition to forgive my shortcomings and the promptness and business-like support, which you and your predecessor have given me, which prevented it.

Yours very respectfully,

A. C. CARTON,

Special Representative of the State Land Office.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